

# Operation & Maintenance Manual Paddle Dryer

Model: 15W-3000-LC  
K-S Job #: D-0493  
Serial #: DS-353

WILLIAMS BROTHERS CONSTRUCTION  
LAKE COUNTY, IL  
DES PLAINES RIVER WRF  
Customer PO#: 9301-483R

## Volume 2B – Dry Silos

Parts, Filter Fabric & Belts:	Tel:	800-225-5457
	Fax:	800-329-7457
Customer Service:	Tel:	800-225-5457



**Komline-Sanderson**

12 Holland Av  
908-234-1000

Peapack, NJ 07977-0257  
Fax: 908-234-9487  
[www.komline.com](http://www.komline.com)

## **Index of Tabs: Volume 2B**

### **Auxiliary Equipment (Dry Silos)**

*Tabbed Section*

*Vendor*

- |                                   |             |
|-----------------------------------|-------------|
| 1. Dry Product Silos              | CST Storage |
| 2. Dry Silo Vibrating Dischargers | MetalFab    |
| 3. Dry Silo Automatic Slide Gates | PEBCO       |
| 4. Dry Silo Load Out Spouts       | PEBCO       |
| 5. Dry Silo Dust Collector        | UAS         |
| 6. Silo Bin Vent                  | Coperion    |





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## OPERATION AND MAINTENANCE MANUAL

Title of Project: Lake County Public Works Department  
Des Plaines River WRF  
Phases 2B & 3 Improvements

Specification Number: 11650H  
Specification Title: Biosolids Thermal Drying System  
Dry Product Silos  
Tags: M-12-5 (Silo No. 1)  
M-12-8 (Silo No. 2)  
M-12-11(Silo No. 3)

Manufacturer: CST Storage

General Contractor: Williams Brothers Construction, Inc.

Subcontractor:

Supplier: Komline-Sanderson

O&M MANUAL SUBMITTAL CHECKLIST (Page 1 of 5)

PROJECT NAME Des Plaines River WRF

CONTRACT NO. K-S Job D0493

CONTRACTOR Komline-Sanderson

EQUIPMENT/SYSTEM Biosolids Drying System Dry Silo Tanks

SECTION NO. 11650H

MANUFACTURER/VENDOR CST Storage

FORMAT

Size:	8-1/2 x 11 or 11 x 17
Paper:	20-pound minimum
Text:	Printed data/neatly typed
Drawings:	Standard size bound in text; in text-size labeled envelopes

Tabbed Section Dividers

Cover Label:	Title
	Project Name
	Building/Structure ID
	Equipment Name
	Specification Section

Binders:	Plastic Cover
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## O&M MANUAL SUBMITTAL CHECKLIST (Page 2 of 5)

### GENERAL CONTENTS

<u>Provided</u>	<u>Not Applicable</u>	<u>Page No.</u>	
<u>  X  </u>	<u>      </u>	<u>  1,7  </u>	One Specification Only
<u>  X  </u>	<u>      </u>	<u>  1,7  </u>	Title Page:
<u>  X  </u>	<u>      </u>	<u>    1  </u>	Title
<u>      </u>	<u>  X  </u>	<u>      </u>	Project title
<u>  X  </u>	<u>      </u>	<u>    1  </u>	Building/structure ID
<u>  X  </u>	<u>      </u>	<u>    1  </u>	Equipment name
<u>  X  </u>	<u>      </u>	<u>    1  </u>	Specification section number
<u>      </u>	<u>      </u>	<u>    1  </u>	Contractor ID
<u>      </u>	<u>  X  </u>	<u>      </u>	Subcontractor ID
<u>  X  </u>	<u>      </u>	<u>   14  </u>	Purchase order data
<u>  X  </u>	<u>      </u>	<u>    1  </u>	Manufacturer ID
<u>  X  </u>	<u>      </u>	<u>    1  </u>	Service/parts supplier ID
<u>  X  </u>	<u>      </u>	<u>Varies</u>	Product List
<u>      </u>	<u>  X  </u>	<u>      </u>	Table of Contents
<u>      </u>	<u>  X  </u>	<u>      </u>	Tabbed Sections:
<u>  X  </u>	<u>      </u>	<u>Varies</u>	Pertinent data sheets
<u>      </u>	<u>      </u>	<u>      </u>	Annotated as needed
<u>      </u>	<u>  X  </u>	<u>      </u>	Text:
<u>      </u>	<u>  X  </u>	<u>      </u>	Pertinent to project
<u>      </u>	<u>  X  </u>	<u>      </u>	Annotated
<u>  X  </u>	<u>      </u>	<u>26-41</u>	Drawings:
<u>  X  </u>	<u>      </u>	<u>Varies</u>	Illustrate product and components
<u>      </u>	<u>  X  </u>	<u>      </u>	Control and flow diagrams
<u>      </u>	<u>  X  </u>	<u>      </u>	Special Information:
<u>  X  </u>	<u>      </u>	<u>26-41</u>	Interrelationships of equipment and components
<u>  X  </u>	<u>      </u>	<u>Varies</u>	Instructions and procedures
<u>  X  </u>	<u>      </u>	<u>Varies</u>	Instructions organized in
<u>  X  </u>	<u>      </u>	<u>Varies</u>	Instructions in logical
<u>      </u>	<u>  X  </u>	<u>      </u>	Glossary
<u>      </u>	<u>  X  </u>	<u>      </u>	Warranty, Bond, Service Contract

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MANUAL FOR MATERIALS AND FINISHES

<u>Provided</u>	<u>Not Applicable</u>	<u>Page No.</u>	
_____	<u>X</u>	_____	Building Products:
_____	<u>X</u>	_____	Product data
_____	<u>X</u>	_____	Catalog number
_____	<u>X</u>	_____	Size
_____	<u>X</u>	_____	Composition
_____	<u>X</u>	_____	Color and texture designations
_____	<u>X</u>	_____	Care and Maintenance Instructions
_____	<u>X</u>	_____	Recommended cleaning agents and methods
_____	<u>X</u>	_____	Cleaning precautions
_____	<u>X</u>	_____	Cleaning and maintenance schedule
_____	<u>X</u>	_____	Moisture Protection Products:
_____	<u>X</u>	_____	Product data listing
_____	<u>X</u>	_____	Chemical composition
_____	<u>X</u>	_____	Installation details
_____	<u>X</u>	_____	Inspection recommendations
_____	<u>X</u>	_____	Maintenance and repair
_____	<u>X</u>	_____	Additional Data as Required

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MANUAL FOR EQUIPMENT AND SYSTEMS

<u>Provided</u>	<u>Not Applicable</u>	<u>Page No.</u>	
<u>X</u>	<u>X</u>	<u>Varies</u>	Description of Unit and Components:
<u>      </u>	<u>X</u>	<u>      </u>	Equipment functions
<u>      </u>	<u>X</u>	<u>      </u>	Normal operating characteristics
<u>      </u>	<u>X</u>	<u>      </u>	Limiting conditions
<u>      </u>	<u>X</u>	<u>      </u>	Performance curves
<u>X</u>	<u>      </u>	<u>Varies</u>	Engineering data
<u>      </u>	<u>X</u>	<u>      </u>	Test data
<u>      </u>	<u>X</u>	<u>      </u>	Replaceable parts list (with numbers)
<u>      </u>	<u>X</u>	<u>      </u>	P&ID numbers
<u>      </u>	<u>X</u>	<u>      </u>	Operating Procedures:
<u>      </u>	<u>X</u>	<u>      </u>	Startup
<u>      </u>	<u>X</u>	<u>      </u>	Break-in
<u>      </u>	<u>X</u>	<u>      </u>	Routine/normal operation
<u>      </u>	<u>X</u>	<u>      </u>	Regulation and control
<u>      </u>	<u>X</u>	<u>      </u>	Stopping and shutdown
<u>      </u>	<u>X</u>	<u>      </u>	Emergency
<u>      </u>	<u>X</u>	<u>      </u>	Seasonal operation
<u>      </u>	<u>X</u>	<u>      </u>	Special instructions
<u>      </u>	<u>X</u>	<u>      </u>	Maintenance Procedures:
<u>      </u>	<u>X</u>	<u>      </u>	Routine/normal instructions
<u>      </u>	<u>X</u>	<u>      </u>	Troubleshooting guide
<u>      </u>	<u>X</u>	<u>      </u>	Disassembly/reassembly/repair
<u>      </u>	<u>X</u>	<u>      </u>	Alignment/adjusting/balancing
<u>      </u>	<u>X</u>	<u>      </u>	Servicing and Lubrication:
<u>      </u>	<u>X</u>	<u>      </u>	List of lubricants
<u>      </u>	<u>X</u>	<u>      </u>	Lubrication schedule
<u>      </u>	<u>X</u>	<u>      </u>	Maintenance schedule
<u>X</u>	<u>      </u>	<u>Varies</u>	Safety Precautions/Features
<u>      </u>	<u>X</u>	<u>      </u>	Sequence of Operation of Controls
<u>X</u>	<u>      </u>	<u>26-41</u>	Assembly Drawings
<u>X</u>	<u>      </u>	<u>Varies</u>	Parts List and Illustrations:
<u>      </u>	<u>X</u>	<u>      </u>	Predicted life
<u>      </u>	<u>X</u>	<u>      </u>	Recommended spare parts list and prices
<u>      </u>	<u>X</u>	<u>      </u>	Control Diagrams/Schematics
<u>      </u>	<u>X</u>	<u>      </u>	Bill of Materials

O&M MANUAL SUBMITTAL CHECKLIST      (Page 5 of 5)

<u>Provided</u>	<u>Not Applicable</u>	<u>Page No.</u>	
<u>  X  </u>	<u>      </u>	<u>14, 21</u>	Completed Equipment Data Form per Specification
<u>      </u>	<u>  X  </u>	<u>      </u>	Valves
<u>  X  </u>	<u>      </u>	<u>Varies</u>	Catalog Cuts and Tag Numbers
<u>  X  </u>	<u>      </u>	<u>Varies</u>	Maintenance Instructions
<u>      </u>	<u>  X  </u>	<u>      </u>	Panelboard Directories:
<u>      </u>	<u>  X  </u>	<u>      </u>	Electrical
<u>      </u>	<u>  X  </u>	<u>      </u>	Controls
<u>      </u>	<u>  X  </u>	<u>      </u>	Communications
<u>      </u>	<u>  X  </u>	<u>      </u>	Instrumentation Loops:
<u>      </u>	<u>  X  </u>	<u>      </u>	Diagrams
<u>      </u>	<u>  X  </u>	<u>      </u>	Components list each circuit/loop
<u>      </u>	<u>  X  </u>	<u>      </u>	Additional Data As Required

# CST Storage

Sales Order No. 15-4663, 15-4664, and 15-4665

Dry Bulk Storage Silos

Operation and Maintenance Manual

Project Name: Des Plaines River WRF

Komline Sanderson Engineering



Contents

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MANWAY/PRV HATCH .....7

EXPLOSION VENT PANEL .....14

# **BOLTED SILO**

## Columbian TecTank Product



## O&M Manual for Columbian TecTank

Continuous and satisfactory operation of the tank requires periodic inspection and maintenance to identify and correct any potential issues as they arise. Below is a minimum recommended inspection that should be completed on a regular basis.

### A. MONTHLY INSPECTIONS

A monthly inspection should be completed by owner or operations personnel. Any discrepancy or sign of damage should be repaired immediately.

1. Check for and remove any debris that may have accumulated outside the tank, particularly any debris that is in contact with the tank shell or appurtenances attached to the tank. Remove any mud, oil, or other foreign material on the tank shell.
2. Check all seams for any signs of leaks. If a leak is detected, check tightness and tighten all bolts within one-square foot area of the leak. Monitor the area until leak is eliminated.
3. Check all seams for any distortion that may have occurred from undue structural stress.
4. Check to make sure that there is sufficient drainage away from the tank and no water is standing under or near the foundation.

### B. ANNUAL INSPECTIONS

An annual inspection should be completed by the owner to ascertain the condition of the tank. The inspection should identify any signs of corrosion, product leakage, coating damage, equipment malfunction, and any other item related directly or indirectly with the performance or safety of the tank. All corrective action should be completed immediately after a problem is identified. In addition to the monthly inspection, the following should be examined.

1. Examine the concrete ringwall or slab foundation for fractures that may have developed. Fractures or other distortion can cause eccentric loading on the steel tank and may lead to structural damage or failure.
2. Check for voids or gaps between the tank bottom and the concrete ringwall or slab foundation that may be caused by foundation settlement.
3. Check the anchor bolts and grout (if applicable) to ensure the nuts are tight and grout is not cracked.
4. For tanks with granular foundations, check for washouts or other signs of loose or missing backfill.
5. Examine the deck for sagging, water standing on the deck, or other foreign material on top of the tank.
6. Inspect tank for signs of external corrosion or other coating damage and repair.
7. Inspect all fittings and appurtenances for signs of leaking or loose connections.

The appurtenances on the tank should be serviced on a regular basis and inspected annually or more frequently as required.

1. Thieffatches (pressure/vacuum) should be inspected and have the seat ring and gasket wiped clean. Check the valve for free movement. In cold environments, inspect for icing caused by condensation. Clean screen of all debris that it has collected. Check for screen deterioration and replace if necessary.



## O&M Manual for Columbian TecTank

2. Free flowing vents should have the screen cleaned of debris and checked for deterioration. Replace if necessary. In cold environments, inspect for icing caused by temperature difference.
3. Nozzles and connecting pipes should be checked for distortion of the tank wall at the point of connection or stress within the nozzle or piping caused by settling between the tank and the piping. This situation must be remedied immediately.
4. Liquid level indicators should be examined for smooth operation, build-up of foreign material, or signs of float cable wear or damage. Check that all connections are tight. In cold environments, check for ice build-up.
5. Visually inspect all valves, sample boxes, sight glass, pressure gauges, and all other appurtenances located on the tank.
6. Inspect the external ladder, platforms, and handrails for damage or loose bolts.
7. Inspect all lightning rods, conductors and connections.

### C. PERIODIC INTERNAL INSPECTIONS

The tank should be drained and internally inspected initially within the warranty period, and then at least every three to five years thereafter, or more frequently if the owner determines that conditions warrant an internal inspection or if required by local, state, or national laws and regulations.

The owner should provide knowledgeable personnel familiar with tank entry and should follow all safety rules regarding tank entry, including but not limited to isolation of potential energy sources, identification of any potential hazards, and confined space entry procedures.

An internal inspection may require removal of any sediment that has accumulated in the tank and the tank may need to be flushed or cleaned out.

Any discrepancy or sign of damage to the tank or coating should be repaired immediately. An internal inspection should include, but is not limited to, the following:

1. Check complete interior, including deck structure, underside of deck, internal ladders, interior nozzles and appurtenances, and other structure for signs of corrosion or other damage.
2. Check internal coating for signs of wear or corrosion caused by flow of liquid, mechanical damage, or coating failure, or damage caused by stored product.
3. Inspect and tighten nuts on the bottom of the tank.
4. Examine the deck and deck structure for any distortion or sign of structural stress.

After the inspection and all repairs are complete, remove all materials, equipment, and tools and clean the tank as required for product quality.

### D. GENERAL

Inspections can be made by the owner's personnel or other qualified personnel. If this is not feasible, or the severity of the problem warrants the need, an experienced tank technician can be hired through Columbian TecTank's Field Service Department by contacting CTT at (913) 621-3700.



## O&M Manual for Columbian TecTank

If any touch-up repairs are required to the coating, CTT can provide a standard touch-up procedure based on the existing coating. Contact CTT for touch-up procedures and materials.

It is recommended that spare hardware be kept on hand to cover normal maintenance or emergency situations. Because of the many types and sizes of tanks and hardware available, contact CTT for your particular application. Generally, parts on hand should include gasket material, caulking, bolts, nuts, and washers. Gaskets and hardware should not be re-used once they have been removed.

Installation of new nozzles or appurtenances or a change of service may void the warranty of the tank. If the tank is being considered for a change of service, the specific gravity of the new liquid must be less than or equal to the liquid previously stored in the tank. It is recommended that any such service or physical changes should be brought to the attention of CTT PRIOR to the change.

**MANWAY/PRV HATCH**  
KNAPPCO

# EQUIPMENT DATA FORM (Page 1 of 3)

PROJECT NAME Des Plaines River WRF

CONTRACT NO. K-S Job D0493

CONTRACTOR Komline-Sanderson

EQUIPMENT NO. HH02051

DESCRIPTION KNAPPCO Manway/PRV Combo 2 oz. Pressure/.5 oz vacuum

LOCATION 800 Krause Drive, Buffalo Grove, IL

MANUFACTURER KNAPPCO

PURCHASED FROM CST Storage PURCHASE DATE 09/21/2015

VENDOR ORDER NO. \_\_\_\_\_ PURCHASE PRICE \_\_\_\_\_

LOCAL SUPPLIER CST Storage PHONE 913-428-7132

ADDRESS 903 E 104<sup>th</sup> St. Suite 900 Kansas City, MO 64131

MODEL NO. HH02051 SHIPPING WT/UNIT 87.5 Lbs.

NO. OF UNITS 4 SERIAL NOS. CST Part No. 50-80-0548-42

## NAMEPLATE DATA

<u>ELECTRIC MOTOR</u>	<u>PUMP/HVAC UNIT</u>	<u>DRIVE/REDUCER</u>	<u>OTHER (I&amp;C)</u>
MANUFACTURER:	MANUFACTURER:	MANUFACTURER:	MANUFACTURER:
_____	_____	_____	_____
TYPE: <input type="checkbox"/> AC <input type="checkbox"/> DC	TYPE _____	TYPE: <input type="checkbox"/> GEAR <input type="checkbox"/> V-BELT <input type="checkbox"/> CHAIN <input type="checkbox"/> VARIDRIVE	TYPE _____
HP _____	SIZE _____		SIZE _____
RPM _____	CAPACITY _____		CAPACITY _____
VOLTAGE _____	PRESSURE _____	SERVICE FACTOR _____	RANGE _____
AMPERAGE _____	ROTATION _____	RATIO _____	
PHASE _____	IMPELLER: SIZE _____		
FRAME _____	MATERIAL _____		

EQUIPMENT DATA FORM (Page 2 of 3)

MAINTENANCE SUMMARY

EQUIPMENT NO. CST Part No. 50-80-0548-42

DESCRIPTION KNAPPCO Manway/PRV Combo

MAINTENANCE OPERATION

List briefly each maintenance operation required and refer to specific information in Manufacturer's Maintenance Manual, if applicable. Refer by symbol to "Lubricant List" for Lubrication Operation.

FREQUENCY

List required frequency of each maintenance operation.

DO NOT ADJUST OR ALTER PRV SETTINGS

Inspect weather cover for damage

Monthly

Inspect cover for operation and functioning hardware

Monthly

Reference HH Data Sheet



EQUIPMENT DATA FORM (Page 3 of 3)

## LUBRICANT/RECOMMENDED SPARE PARTS LIST

EQUIPMENT NO. CST Part No. 50-80-0548-42DESCRIPTION KNAPPCO Manway/PRV Combo**LUBRICANT LIST**

<u>LUBRICANT REFERENCE SYMBOL</u>	<u>LUBRICANT TYPE (MILITARY STANDARD)</u>	<u>RECOMMENDED AND MANUFACTURER</u>
List symbol in "maintenance operation"	List general lubricant type	List specific lubricant name, viscosity and manufacturer
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>

**RECOMMENDED SPARE PARTS LIST**

<u>PART NO.</u>	<u>DESCRIPTION</u>	<u>UNIT</u>	<u>QUANTITY</u>	<u>UNIT COST</u>
<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
<hr/>	<hr/>	<hr/>	<hr/>	<hr/>

NOTE: Identify parts provided by this Contract with two asterisks.

## ADDITIONAL DATA AND REMARKS

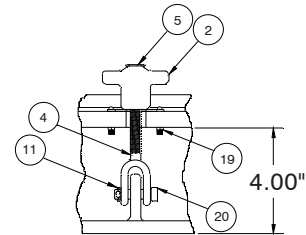
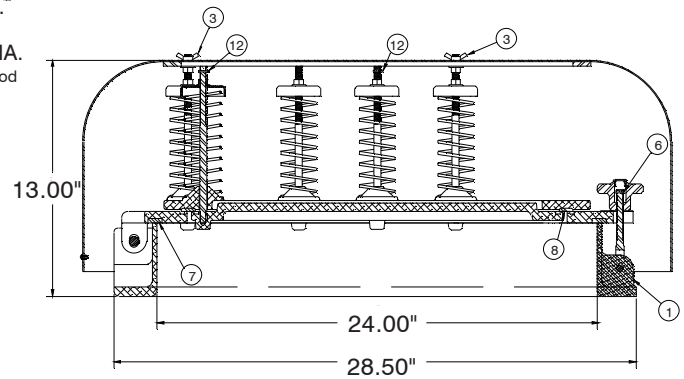
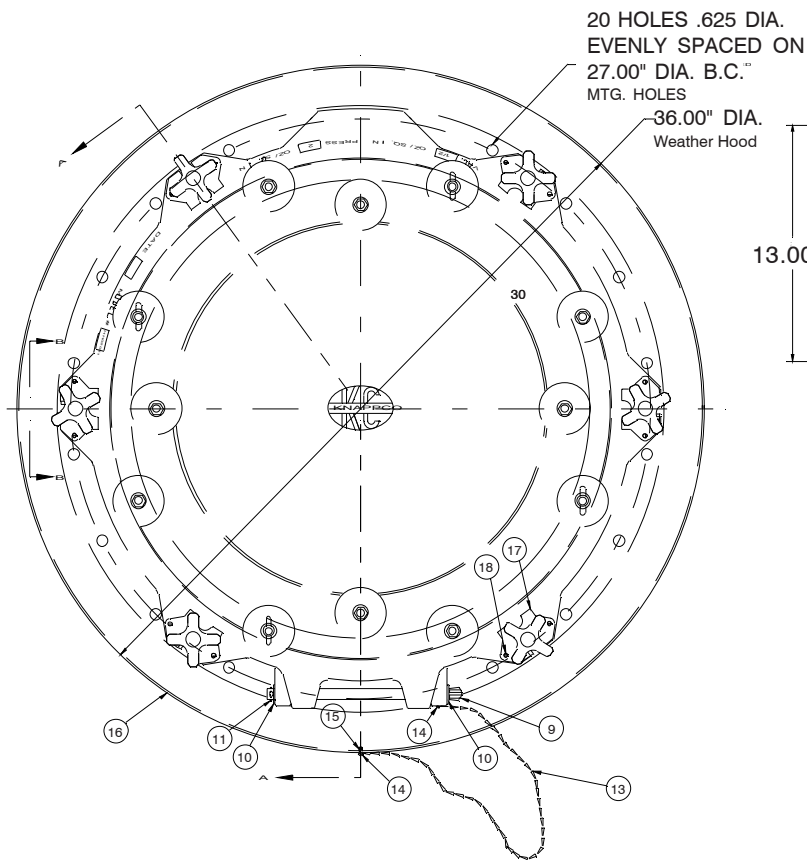
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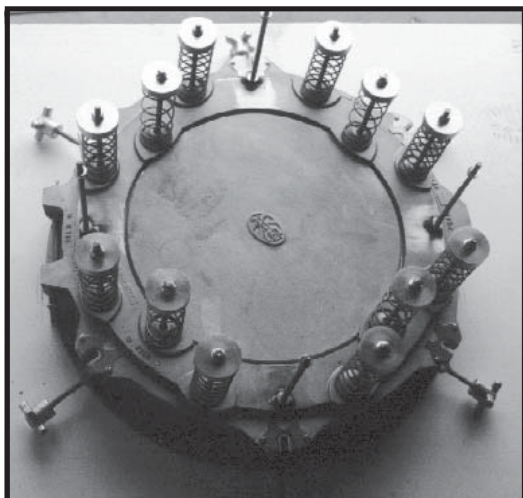
## HH 24" PRESSURE / VACUUM TANK HATCH

REFERRALS	DESCRIPTION	ALUMINUM	PLATED	SS	OTHER
1	Base Ring	5709			
2	Hand Knob (6)		5717		
3	Wing Nut (4)		5695		
4	Jaw End Stud (6)		5718		
5	Plug Button (6)		5719		
6	Roll Pin (6)		5720		
7	Cover Gasket (White Food Grade)				5722
8	Poppet Gasket ( White Food Grade)				5723
9	Hinge Pin		5724		
10	Washer (2)		1043		
11	Cotter Pin (7)		1045		
12	Cotter Pin (4)		1537		
13	Chain		3589		
14	Screw (2)		2716		
15	Nylock Nut			3544	
16	Weather Hood	5699			
17	Wear Plate (6)			2592	
18	Screw 10-32 x 1 1/8 (12)			3546	
19	Lock Nut (12)			3544	
20	Pivot Pin (6)		5728		

Pressure and Vacuum settings are factory set, do not attempt to change or alter settings.

Relieve all pressure and / or vacuum before attempting to open the cover.

# HH 24" PRESSURE / VACUUM TANK HATCH FOR BULK STORAGE TANKS



Hatch shown without protective weather hood.

## APPLICATIONS:

- Silos
- Grain elevators
- Baghouses

## MARKETS:

- Cement
- Food products
- Grains
- Industrial products



Hatch shown with protective weather hood.

## Features:

- Larger 24" opening provides higher venting capacity and improved access into the tank.
- Palm nuts allow for quick and easy opening.
- Available with various pressure and vacuum settings.
- All aluminum contact parts; NO RUST!
- Standard white FDA approved gasket.
- No internal hardware to contaminate product.
- Weather hood provides weather protection.
- Base bolts directly to the tank.

OVERALL HEIGHT: 13.00" (Approximately)

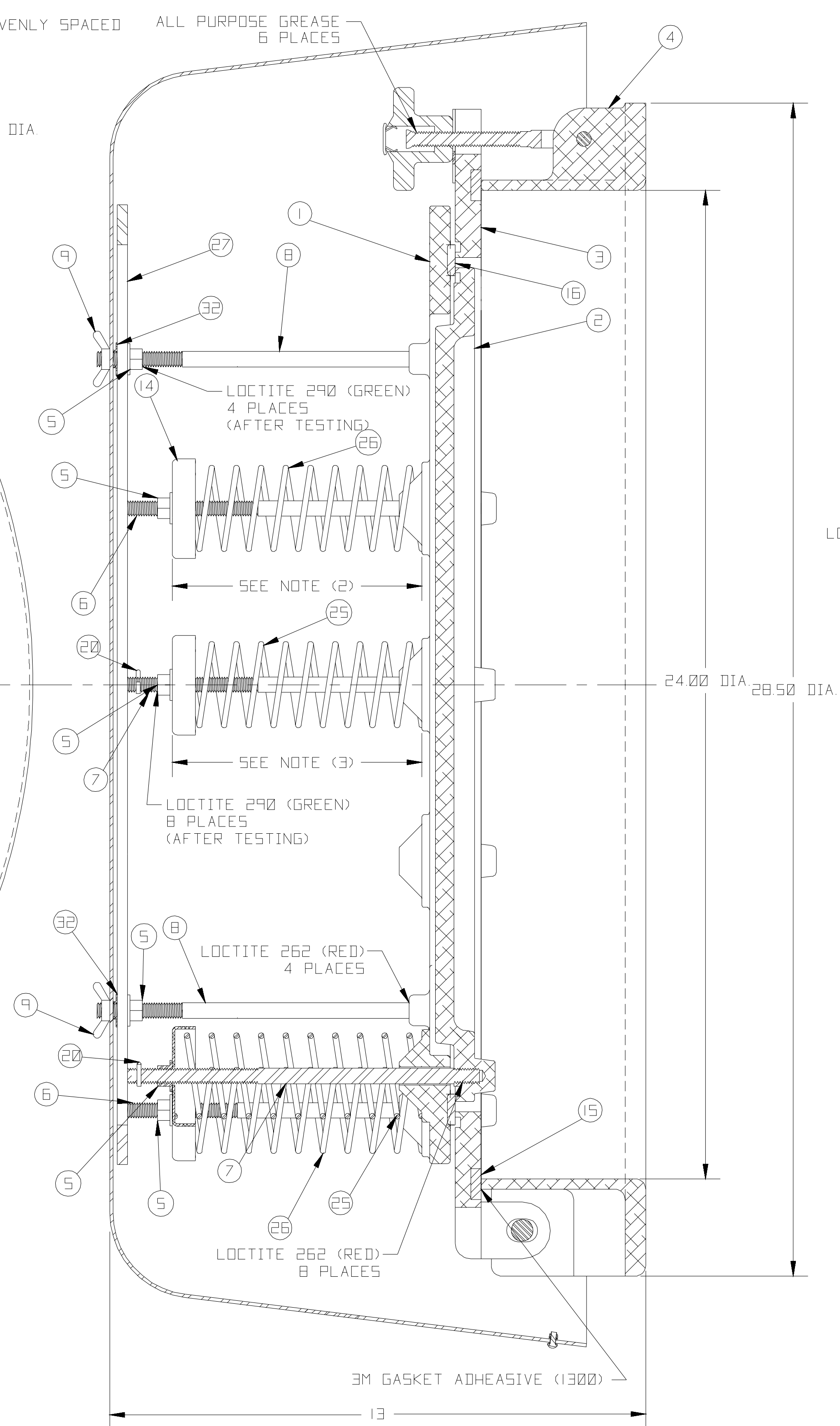
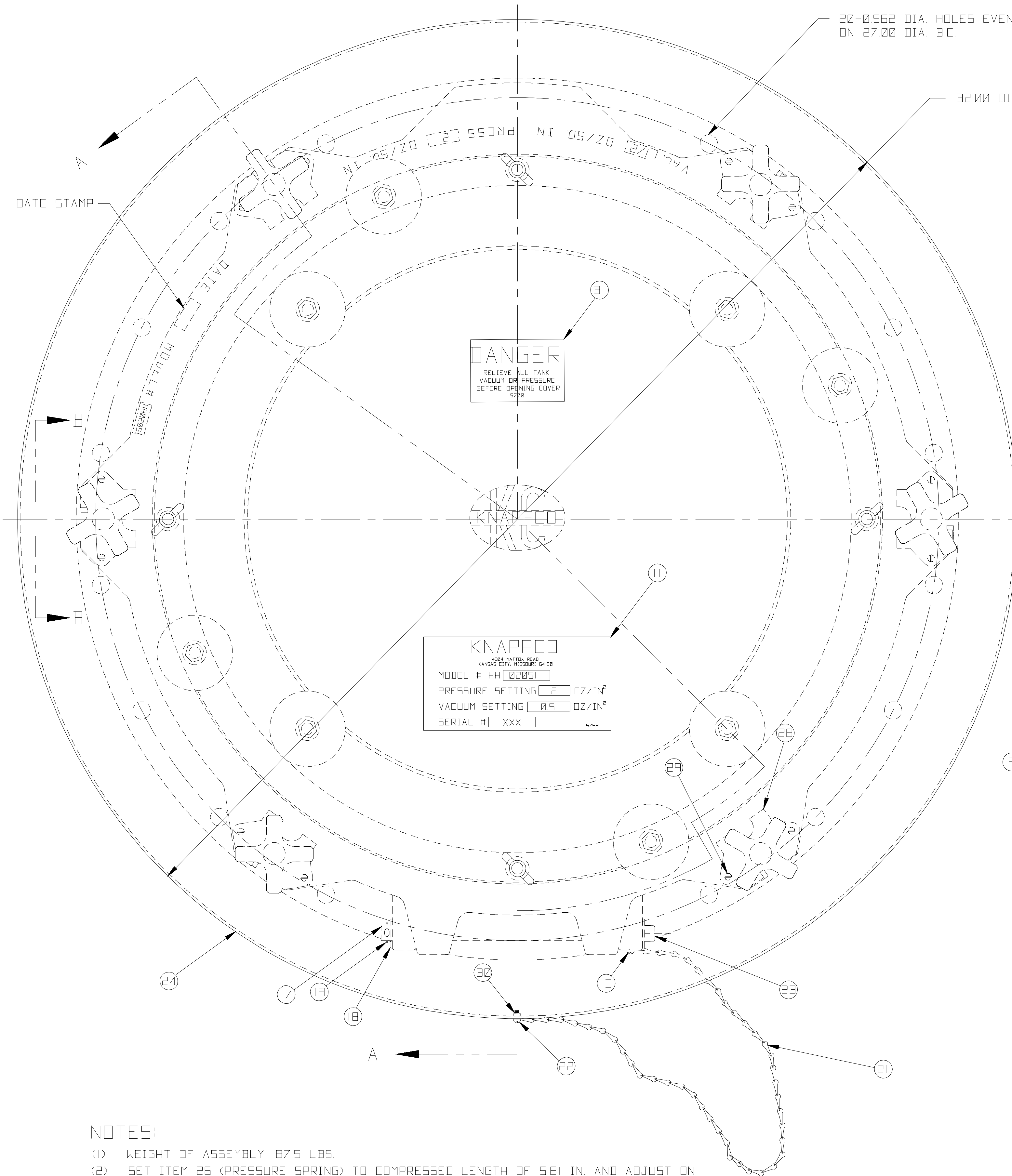
AVERAGE SHIPPING WEIGHT: 81lbs

MODEL	Pressure Setting (ounces/square inch)	Vacuum Setting (ounces/square inch)	#	Gasket
HH	Settings: 02 to 16 (increments of 2)  Please indicate pressure setting utilizing first 2 digits	Setting: 0.5 (other setting available)  Please indicate vacuum setting utilizing second 2 digits	1	White Food Grade  Last digit

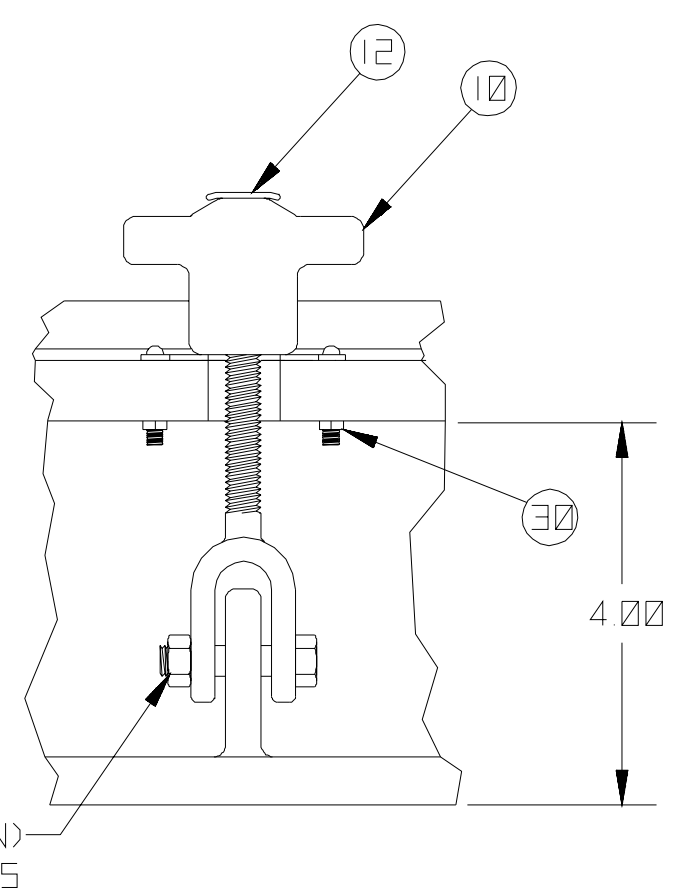
Example: HH02051 (Model HH, pressure setting 2 oz, vacuum setting .5 oz, gasket white buna)

**Warning:** Cover should be inspected at least once each month for proper operation and proper functioning hardware. The weather hood should be inspected for damage. If items are missing or damaged they should be replaced.

F-5



REVISION			
LETTER	DESCRIPTION	BY	DATE
A	REVISED AND REDRAWN	AEM	9/20/94
B	REVISED TO BOM	RB	3/8/95
C	REVISED TO MATCH BOM	RDW	6/2/95
D	ADDED ASSY. NOTES	RDW	8/17/95
E	REVISED ITEM (5) LOCATIONS	RDW	12/18/95
F	QTY. FOR ITEM (18) WAS 2	RDW	12/21/95



VIEW B-B

32	5144	CLIP, RETAINING (3/8-16)	2
31	5770	DECAL (DANGER, FOIL)	1
30	3544	NUT LOCK (10-32 S.S.)	13
29	3546	SCREW (10-32 X 1 1/8, S.S.)	12
28	2592	WEAR PLATE (S.S.)	6
27	5727	REINFORCEMENT RING (AL.)	1
26	5726	SPRING, PRESSURE (S.S.)	4
25	5725	SPRING, VACUUM (S.S.)	4
24	5699	WEATHER HOOD (ALUM.)	1
23	1020	PALNUT (PLD)	1
22	2716	SCREW 10-32 (PLD)	1
21	3589	CHAIN (PLD)	1
20	1567	COTTER PIN (PLD)	4
19	1045	COTTER PIN (PLD)	1
18	1043	WASHER (PLD)	1
17	5724	PIN, HINGE (PLD)	1
16	5723	GASKET, POPPET (W. BUNA)	1
15	5722	GASKET, COVER (W. BUNA)	1
14	5721	RETAINER, SPRING (S.S.)	8
13	1375	SCREW, SELF-TAP	1
12	5719	PLUG BUTTON (PLD)	6
11	5752	DECAL (SPEC. FOIL)	1
10	5146	STUD/HAND KNOB ASSY	6
9	5695	WING NUT (PLD)	4
8	5712	STUD (HOOD STANDOFF S.S.)	4
7	5711	STUD (VACUUM S.S.)	4
6	5710	STUD (PRESSURE S.S.)	4
5	5694	NUT (FLANGED LOCK PLD)	12
4	5709	BASE RING (ALUM.)	1
3	5708	MAIN COVER (ALUM.)	1
2	5707	VACUUM POPPET (ALUM.)	1
1	5706	PRESSURE POPPET (ALUM.)	1
ITEM	PART NO	DESCRIPTION	REQ'D

- NOTES:
- (1) WEIGHT OF ASSEMBLY: 875 LBS
  - (2) SET ITEM 26 (PRESSURE SPRING) TO COMPRESSED LENGTH OF 581 IN. AND ADJUST ON TEST FIXTURE UNTIL ONE SIDE H2O MANOMETER READING OF 1.73 IS ACHIEVED
  - (3) SET ITEM 25 (VACUUM SPRING) TO COMPRESSED LENGTH OF 584 IN. AND ADJUST ON TEST FIXTURE UNTIL ONE SIDE H2O MANOMETER READING OF .43 IS ACHIEVED

SECTION A-A

			MATERIAL 356-TSI ALUM.		<div>KNAPPCO</div> <div>4304 MATTOX ROAD KANSAS CITY, MISSOURI 64150</div>	
			TOLERANCE UNLESS OTHERWISE SPECIFIED			
			FRACTIONAL ± 1/16			
			DECIMAL .XX ± .030 XXX ± .010			
			ANGLE ± 0° 30'		TITLE TANK HATCH 2oz PRES, .5oz VAC.	
ITEM DWG. NO. REQ'D			Dwg. BY DAK DATE 3/15/94 APP'D BY DATE			
NEXT ASSY.					SCALE 1=2	NO HH02051

**EXPLOSION VENT PANEL**  
**FIKE**

# EQUIPMENT DATA FORM (Page 1 of 3)

PROJECT NAME Des Plaines River WRF

CONTRACT NO. K-S Job D0493

CONTRACTOR Komline-Sanderson

EQUIPMENT NO. CV 06-308-1

DESCRIPTION Fike Explosion Vents

LOCATION 800 Krause Drive, Buffalo Grove, IL

MANUFACTURER Fike

PURCHASED FROM CST Storage PURCHASE DATE 09/21/2015

VENDOR ORDER NO. \_\_\_\_\_ PURCHASE PRICE \_\_\_\_\_

LOCAL SUPPLIER CST Storage PHONE 913-428-7132

ADDRESS 903 E 104<sup>th</sup> St. Suite 900 Kansas City, MO 64131

MODEL NO. 06-308-1-7 SHIPPING WT/UNIT \_\_\_\_\_

NO. OF UNITS 16 SERIAL NOS. CST Part No. 99-02-2813-62

## NAMEPLATE DATA

<u>ELECTRIC MOTOR</u>	<u>PUMP/HVAC UNIT</u>	<u>DRIVE/REDUCER</u>	<u>OTHER (I&amp;C)</u>
MANUFACTURER:	MANUFACTURER:	MANUFACTURER:	MANUFACTURER:
_____	_____	_____	_____
TYPE: <input type="checkbox"/> AC <input type="checkbox"/> DC	TYPE _____	TYPE: <input type="checkbox"/> GEAR <input type="checkbox"/> V-BELT <input type="checkbox"/> CHAIN <input type="checkbox"/> VARIDRIVE	TYPE _____
HP _____	SIZE _____		SIZE _____
RPM _____	CAPACITY _____		CAPACITY _____
VOLTAGE _____	PRESSURE _____	SERVICE FACTOR _____	RANGE _____
AMPERAGE _____	ROTATION _____	RATIO _____	
PHASE _____	IMPELLER: SIZE _____		
FRAME _____	MATERIAL _____		





EQUIPMENT DATA FORM (Page 3 of 3)

## LUBRICANT/RECOMMENDED SPARE PARTS LIST

EQUIPMENT NO. CST Part No. 99-02-2813-62DESCRIPTION Fike Explosion Vents 44" x 69"**LUBRICANT LIST**

<u>LUBRICANT REFERENCE SYMBOL</u>	<u>LUBRICANT TYPE (MILITARY STANDARD)</u>	<u>RECOMMENDED AND MANUFACTURER</u>
List symbol in "maintenance operation"	List general lubricant type	List specific lubricant name, viscosity and manufacturer
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**RECOMMENDED SPARE PARTS LIST**

<u>PART NO.</u>	<u>DESCRIPTION</u>	<u>UNIT</u>	<u>QUANTITY</u>	<u>UNIT COST</u>
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NOTE: Identify parts provided by this Contract with two asterisks.

## ADDITIONAL DATA AND REMARKS

Explosion vent frame manufactured by CST to fit the silo. All inquiries regarding the frame should be directed  
to CST Industries. 913-428-7132



### WARNING

- Read these instructions carefully and completely before attempting to unpack, install or service the explosion vent.
- Handle the explosion vent with extreme care. DO NOT bend, poke, or in any way distort the explosion vent.
- Do not locate vent assembly where personnel are exposed to the vent or the area above or in front of the vent, as they may be injured by the release of pressure, flame, noise, particles, and/or process material.
- Locate the explosion vent so that the discharge does not ignite other combustibles, resulting in an ensuing fire or secondary explosion.
- Interfacing equipment and/or machinery must also be protected.
- Flow arrows on round explosion vent tags, or explosion vent tag for square and rectangular vents must be directed to the atmospheric side of the process. Provisions shall be made to prevent personnel from standing or walking on vents, as they risk falling through.
- The vent opening is to be left free and clear. Nothing, i.e. goods or products, is allowed to obstruct the vent area as this will decrease vent efficiency.
- Install the enclosed DANGER sign in a conspicuous location near the zone of potential danger.

### GENERAL

An explosion vent is a pressure relief device, designed to give an instantaneous opening at a predetermined pressure. Its purpose is to protect the equipment from excessive pressures caused by dust or gas deflagrations.

### INSPECTION/PREPARATION

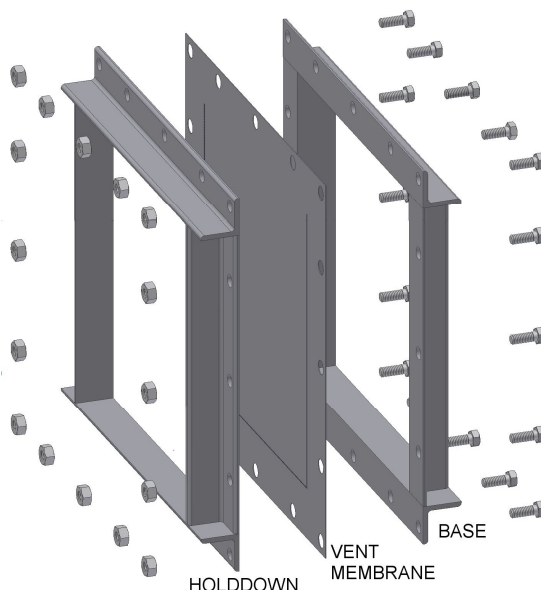
**WARNING:** Always handle the explosion vent with extreme caution. Handle the explosion vent by its edges only. Damage to the functional area (center) or seat area of the explosion vent may adversely affect the performance of the explosion vent. Read the explosion vent tag completely before installing to confirm that the size and type are correct for your system.

1. Carefully remove the explosion vent from its packaging container.
2. Inspect the explosion vent for damage.
3. If foreign material is present, carefully clean the explosion vent with a solvent that is compatible with your media.
4. Two personnel are recommended for handling of all vents larger than 24" x 30" (600 x 1000 mm) (rectangular) and 30" (800 mm) (round) or larger.
5. CV-SF vents require vent frames with back-up bars to properly function (consult Fike for back-up bar design requirements).

**CAUTION:** The CV-SF vent frame may prohibit bag filters/cages to pass through the vent opening, thereby limiting the effectiveness of the venting process. Consult Fike.

### INSTALLATION - OPEN DISCHARGE

**WARNING:** The vent opening should be left free and clear. Do not insulate any part of the explosion vent or frame without consulting Fike.



**IMPORTANT:** When explosion vents are installed horizontally, the use of drainage/weep holes in the holddown frame is required.

1. Use base/inlet of explosion vent frame as a template to indicate placement of explosion vent on the vessel or duct to be protected.
2. Cut the vessel or duct opening to the marked size. The marked size should match the size identified on the vent tag.
3. Weld or bolt the inlet angle frame to the vessel or duct.

**IMPORTANT:** The explosion vent frame must be installed such that the seat area is flat and bolt holes remain perpendicular (square and rectangular vent frames) or circular (round vent frames).

4. If sealing is a particular concern due to the nature of the process, apply a process compatible silicone sealant or gasket to provide seal between explosion vent and inlet frame.
5. If using a gasket, select a gasket material that is compatible with the process, with a suggested thickness of 1/16" (1.5 mm). The gasket is to have the same inside diameter and outside diameter as the explosion vent frame. Gaskets may or may not be included with the selected explosion vent; consult Fike for details.
6. Install the explosion vent and outlet flange aligning the bolt holes. DO NOT force the explosion vent hole alignment.
7. Apply light oil to the threads and install the nuts and bolts hand tight.
8. Torque each bolt to the value identified on the explosion vent tag.

**CAUTION:** The torque values should not be exceeded as this may cause failure of the bolt and/or damage to the vent.

### INSTALLATION - WITH FLAMQUENCH II SQ (FQIISQ)

For additional information, refer to FQIISQ installation instructions, E06-085.

**WARNING:** The vent opening should be left free and clear. Do not insulate any part of the explosion vent or frame without consulting Fike.

1. Use base/inlet of explosion vent frame as a template to indicate placement of explosion vent on the vessel or duct to be protected. Cut the vessel or duct opening to the marked size. The marked size should match the size identified on the vent tag.

**IMPORTANT:** The FQIISQ uses an alignment hole feature to ensure proper orientation of the hinge of the explosion vent. The alignment hole must be included on the mounting frame so the explosion vent and FQIISQ can be mounted in only the prescribed orientation. Consult factory for FQIISQ bolting pattern.

2. Weld or bolt the inlet angle frame to the vessel or duct.

**IMPORTANT:** The explosion vent frame must be installed such that the seat area is flat and bolt holes remain perpendicular (square and rectangular vent frames).

3. Install gaskets on both sides of the explosion vent. Select a gasket material that is compatible with the process, with a suggested thickness of 1/16" (1.5 mm). The gasket is to have the same inside diameter and outside diameter as the explosion vent frame. Gaskets may or may not be included with the selected explosion vent; consult Fike for details.
4. Install the explosion vent and outlet flange aligning the bolt holes. DO NOT force the explosion vent hole alignment.
5. Apply light oil to the threads and install the nuts and bolts hand tight.
6. Torque each bolt to the value identified on the explosion vent tag.

**CAUTION:** The torque values should not be exceeded as this may cause failure of the bolt and/or damage to the vent.

#### BURST INDICATOR

The explosion vents can have as an option an integrated electric burst indicator designed for intrinsically safe service. Refer to Burst Indicator Instructions / Drawing for electrical and dimensional specifications.

**CAUTION:** Unacceptably high voltage or currents will permanently damage the electrical system and the use of a non approved intrinsically safe power supply may even be the eventual ignition source of a dust or gas explosion. All burst indicators must be installed in an intrinsically safe circuit which conforms to the applicable national standard.

**WARNING:** Do not bend the electrical cable at any angle at a distance of less than 8 inch (20cm) from the mechanical bracing part and do not lift the explosion vent by the electrical cable, as this may damage the electrical circuit.

**WARNING:** The maximum torque values as mentioned on the nameplate must not be exceeded as this will permanently damage the electrical circuit.

#### MAINTENANCE

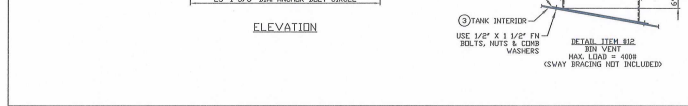
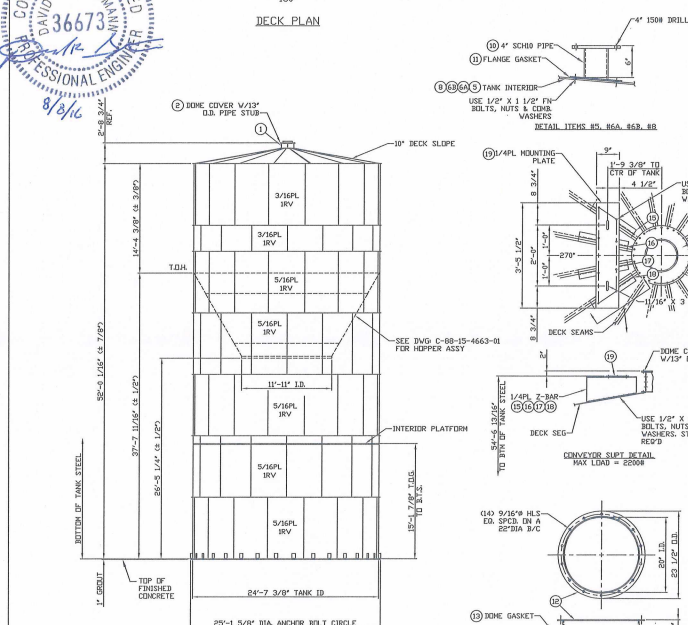
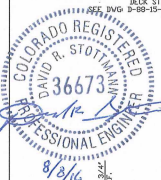
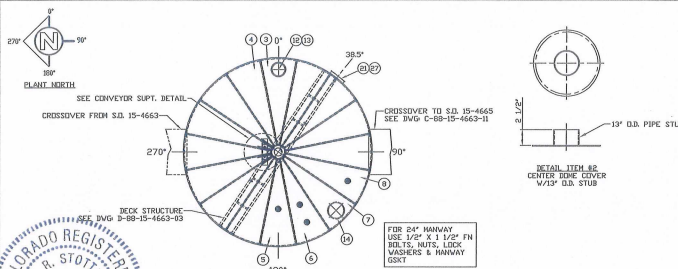
The explosion vent is maintenance-free due to its basic design and concept. Periodic visual inspections should be performed in accordance to the operating parameters and severity of service. All operational system parameters should be observed as a standard maintenance practice. The explosion vent must be replaced if they appear damaged, corroded, or leaking.

**NOTE:** Severe service is defined as rapid changes in pressure, high pressure, high temperature, or corrosive process.










ACCESSORY IDENTIFICATION CHART						
ITEM	SERVICE	SIZE	REF. SYMBOL	RADIUS	ELEVATION FROM BOTTOM OF TANK TO TOP OF HATCH RING	
1,2	DOCK HOOK W/13" B. STUB	20"	CTR	CTR	---	---
3	FILTER FLANGE	20"	0	10-10 3/4"	---	---
5	2500 BRILL FLANGE	4"	100"	7'-6"	---	---
6A	2500 BRILL FLANGE	4"	175 1/2"	10'-0"	---	---
6B	2500 BRILL FLANGE	4"	175 1/2"	10'-0"	---	---
7	MANWAY/FLG	24"	135"	10'-0"	---	---
8	2500 BRILL FLANGE	4"	135 1/2"	10'-0"	---	---
19	CONVEYER SUMP	---	270"	SEE TANK	56'4 1/2" B/W OF P. L.	---
21/27	CONVEYER PIPE BRKT	---	385"	---	EACH CHORD	---
30	BP TOP INLET MANWAY	50"	605	N	N	---
31	20" 3000 BRILL FLANGE	4"	100"	---	---	---
32	60" EXPLOSION PANELS	36" x 48"	---	---	TOP KING	---
33	TRUCK DRIVE THRU	36"/18"	90/270	---	---	GRADE
33A	INTERIOR LADDER	14"	---	---	---	---
33B	CROSSWALK AT LADDER	3' x 4 1/2'	---	---	---	TANK CAVE
* SEE C-80-15-4662-00 IMPROV ACCESS						
* SEE C-80-15-4664-00 FLAT LADDER						
* SEE C-80-15-4665-00 INTERIOR LADDER						
***** SEE C-80-15-4663-H CROSSWALK						

ITEM	SERVICE	SIZE	REF. SYMBOL	RADIUS	ELEVATION FROM BOTTOM OF TANK TO TOP OF HATCH RING
1,2	DOCK HOOK W/13"				

		REFERENCE DRAWINGS	
	STANDARD DETAILS FOR FINE POWDER TANKS	B-50-00-00	
	ERECTION MANUAL GRT7	CT10369	
	HARDWARE	D-50-24-4	
	ANCHOR BOLT LAYOUT	D-88-15-1	
	CROSSOVER ASSY	C-88-15-3	
	FLAT LAYOUT	D-88-15-5	
	HOPPER ASSEMBLY	C-88-15-6	
	INTERIOR PLATFORM ASSY	D-88-15-7	
	PLOT PLAN	D-88-15-8	
	DECK STRUCTURE	D-88-15-9	
	NOTES:		
1/2" X 1 1/2" S0			
S, NUTS & FLAT			
WERS			

	<p>1) THIS TANK IS DESIGNED FOR SYMMETRICAL LOADING (CENTER IS UNLESS DESIGNED) FOR SIZE DISCHARGE, SOME DISCHARGE EQUIPMENT CONFIGURATIONS MAY CAUSE A NON-SYMMETRICAL DISCHARGE PATTERN CERTAIN BULK SOLIDS WHICH COULD RESULT IN STRUCTURAL DAMAGE PRECAUTIONS SHOULD BE TAKEN TO INSURE THE PROPER FLOW PATTERN SYMMETRICAL, CENTER DISCHARGE PATTERN CST STORAGE IS NOT R DAMAGE TO THE TANK AS A RESULT OF A PRODUCT FLOW PATTERN THE INTENDED FLOW PATTERN. THIS TANK IS DESIGNED FOR LOADS FREE FLOWING PRODUCT OF THE INDICATED DENSITY AND FLOW PAT NOT DESIGNED FOR BRIDGING OR MASS FALLING CONDITIONS.</p>
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	2) DO NOT FIELD CUT ANY OPENINGS IN TANK OR APPLY LOADS TO EQUIPMENT, OTHER THAN NOTED ON THIS DRAWING, WITHOUT APPROVAL BY CST STORAGE PRIOR TO INSTALLATION.
ER STUB	3) THIS TANK IS DESIGNED AS AN ATMOSPHERIC UNIT THAT OPERATES AT EQUALIZED PRESSURE INTERNALLY AND EXTERNALLY. CUSTOMER IS TO PROVIDE PROPER VENTILATION IS PROVIDED AND MAINTAINED.
	4) GROUT UNDER BASE PLATES OF COLUMNS AND ENTIRE TANK CHIMNEY DURING ERECTION. GROUT IS TO BE A HIGH STRENGTH NON-SHRINKING WITH A MINIMUM COMPRESSION STRENGTH OF 7000 P.S.I. AT 28 DAYS APPLIED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.

2) FN CONV. GSK	<p>5) FOR COMPLETE ERECTION DETAILS, SEE CST STORAGE'S STANDARD ERECTION MANUAL, CTT0309.</p> <p>6) FOR TANKS SUPPORTED ON STRUCTURAL STEEL, SHIPPING MAY BE BETWEEN THE TANK BASE AND STRUCTURE TO ACHIEVE COMPLETE STABILITY. ARE TO BE FURNISHED AND INSTALLED BY OTHERS.</p> <p>7) FOR TANKS WITH HOPPERS, ALLOWANCE FOR UNRESTRICTED EXPANSION/CONTRACTION OF THE HOPPER IS REQUIRED. FLEXIBLE CONNECTIONS AND DEVICES TO BE DESIGNED, FURNISHED, AND INSTALLED BY OTHERS.</p> <p>TANK DATA:</p>
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1) TANK COATING:	INTERIOR PRODUCT ZONE: TRICO BOND EP INTERIOR SKIRT: TRICO BOND EP V/AVD1726 BEIGE OXP000360 PERFORMANCE URETHANE EXTERIOR TRICO BOND EP V/AVD1726-136 S BEIGE OXP000360 PERFORMANCE URETHANE
2) HARDWARE: GALVANIZED BOLTS V/FLAT WASHERS & HDG HEX NUT COMBINATION WASHERS FOR HOPPER, BECK AND TOP CHIME.	
3) GASKETING:EPDM	
DESIGN DATA/	

1) PRODUCT	DRIED SLUDGE
2) PRODUCT COMPACTED BULK DENSITY	70 LB/CU FT
3) ESTIMATED VOLUME	9,931 CU FT, ELEV
4) FLOW PATTERN	
5) CENTER FILL, CENTER DISCHARGE	
6) DESIGN PRESSURE POSITIVE	4.50 OZ/SQ IN
DESIGN PRESSURE NEGATIVE	0.50 OZ/SQ IN
7) DECK LIEE LOAD	28 LB/SQ FT
8) SNOW LOAD PERIBC 086/ASCE 7-10	pg252, fig. 1w-1.1
9) WIND LOAD PER IBC 2002/ASCE 7-10	10 MPH, CIP, C
10) SEISMIC PER IBC 2002/ASCE 7-10	S=12705, S=0.005, S <sub>1</sub>
SITE CLASS, B, RISK CAT, 3, DESIGN CAT, B, I=1,2,3	

ITEM NO	DATE	POST NO	ITEM	DESCRIPTION	PAID
1	17-09-0015-77	1	DOCK HOOK 20-30 L/W V/RECT FCHG		N
2	30110208-154663A	1	DOCK CURV 3/16" DIA. THRU. STPL		N
3	20110204-154663F	1	BECK 3/16"PL 2" DIA. INDOGS GR50 W/2 L.FH		N
4	20110204-154663A	1	BECK 3/16"PL 2" DIA. INDOGS GR50 W/2 L.FH		N
5	20110204-154663B	1	BECK 3/16"PL 2" DIA. INDOGS GR50 W/2 L.FH		N
6	20110204-154663C	1	BECK 3/16"PL 2" DIA. INDOGS GR50 W/2 4" F.LG PCHG		N
7	20110204-154663B	1	BECK 3/16"PL 2" DIA. INDOGS GR50 W/2 4" F.LG PCHG		N
8	20110204-154663E	1	BECK 3/16"PL 2" DIA. INDOGS GR50 W/2 4" F.LG PCHG		N
9					N
10	70510400-154663A	1	FLG ASSY HELLING INDOGS 1/2" INDOGS BRILL 4" FROD		N
11	870888W285HM	4	NEZZLE HWM KIT W/602 2 1/2" 5/10		N
12	00310504-154663F	1	FLITER PLATE 3/8" DIA. 1/2" DIA. BOLT-IN		N
13	35358R-00001V	1	1/2" VOLT DIA. KIT 250. V/RECT FCHG		N
14	15-10-0546-42	1	HVW/24 2" OZ PRES-5 OZ VAC		N
15	61110000-154663A	1	2 BAR 1/4"IN. SPCL		N
16	61110000-154663B	1	2 BAR 1/4"IN. SPCL		N
17	61110000-154663C	1	2 BAR 1/4"IN. SPCL		N
18	61110000-154663D	1	2 BAR 1/4"IN. SPCL		N
19	61110000-154663E	1	2 BAR 1/4"IN. SPCL		N
20	25910700-154663A	1	CONVEYER LAMP. HANGING PLATE		N
21	751W0602	7	STRIP GASKET MDN-RENGE EPDM		N
22	68370000-154664A	7	CONVEYER PULV 1/4"IN.		N
23	71070004	42	1 1/2" 1/2" L 1/2		


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ITEM	SERVICE	SIZE	REF. SYMBOL	RADIUS	ELEVATION FROM BOTTOM OF TANK TO TOP OF HATCH RING
1,2	DOCK HOOK W/13"				


ANK FROM IN WRITING		(2) 4" O.D. PIPES (3) OTHERS	
ON AN SURE			
AS SHOWN ING GROUT IS TO BE	TANK EXTERIOR  TOTAL TYP. 851 WEIGHT 2000 LBS. APPROX.		

RY TANK	1. INTERIOR SURFACE OF DOCK HOOK W/13" BRACKET DETAIL	NOTES: 1. INTERIOR SURFACE WILL BE 100% HOLIDAY TESTED OVER ENTIRE LENGTH IN PRODUCT ZONE. 2. CST TO PROVIDE ONE COAT ON INTERIOR SURFACE 3 MILS AVERAGE DFT WITH A RANGE OF 3-7 MILS DFT. 3. CST TO PROVIDE ONE COAT OF EPOXY PRIMER ON EXTERIOR SURFACE 5 MILS AVERAGE DFT WITH A RANGE OF 3-7 MILS DFT. ON EXTERIOR FINISH, CST WILL PROVIDE URETHAN TOPCOAT, 3 MILS AVERAGE DFT IN TWO COATS, RANGE 1.5-2 DFT PER COAT.
COURED ST. SHIMS		
IN AND OTHER		

SUNNY	APPROVED FOR CONSTRUCTION PER C&I #9	SND	KRC	IRS	7/25/16
	REVISE INT. SKIRT COATING	BB			6/9/16
	REVISE & RESUBMIT	BB			6/8/16
	REVISED FOR RESUBMIT	CPV			5/17/16
	REVISED FOR RESUBMIT	CPV			5/10/16
	REVISED FOR RESUBMIT	CPV			4/8/16

	REVISE & RESUBMIT	BY	DATE
	REVISION	BY	DATE
		BY	DATE

ELEVATION, DECK & BILL OF MATERIAL  
 24'-7 3/8"Ø x 52' HANG TANK  
 KOMLINE SANDERSON ENGINEERING  
 CHICAGO, IL, USA



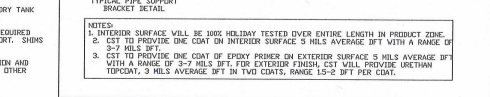
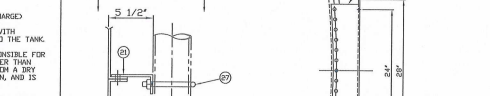
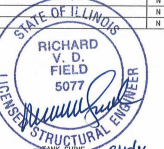
ORDER NO.  
 15-14664

D-524-154664-00



CHG DATE 7/25/2014	ORDER NO. 15-14664
REV DATE 7/25/2014	

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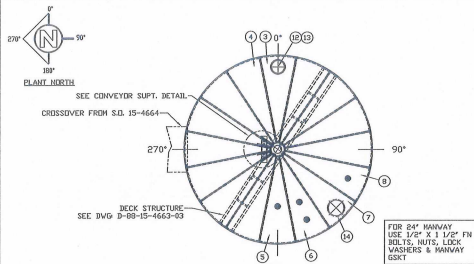
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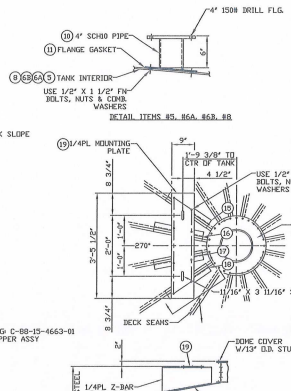
SUN EY	<div><div></div><div></div></div>	APPROVED FOR CONSTRUCTION PER C&I #9	SWD	KRC	IRS	7/25/16
	<div><div></div><div></div></div>	REVISE INT. SKIRT COATING	BB			6/9/16
	<div><div></div><div></div></div>	REVISE & RESUBMIT	BB			6/8/16
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	REVISE & RESUBMIT	BY	CHKD	APR.	DATE
	REVISED	BY	CHKD	APR.	DATE
	REVISION	BY	CHKD	APR.	DATE
		ELEVATION, DECK & BILL OF MATERIAL 24'-7 3/8"Ø x 52' HANG TANK KOMLINE SANDERSON ENGINEERING CHICAGO, IL; USA			
044.pdf		CHG DRS DATE 7/25/2016	15-4664	15-4664-00 D-5024-154664-00	

155, 505, 510, 515, 520, 525, 530, 535, 540, 545, 550, 555, 560, 565, 570, 575, 580, 585, 590, 595, 600, 605, 610, 615, 620, 625, 630, 635, 640, 645, 650, 655, 660, 665, 670, 675, 680, 685, 690, 695, 700, 705, 710, 715, 720, 725, 730, 735, 740, 745, 750, 755, 760, 765, 770, 775, 780, 785, 790, 795, 800, 805, 810, 815, 820, 825, 830, 835, 840, 845, 850, 855, 860, 865, 870, 875, 880, 885, 890, 895, 900, 905, 910, 915, 920, 925, 930, 935, 940, 945, 950, 955, 960, 965, 970, 975, 980, 985, 990, 995, 1000, 1005, 1010, 1015, 1020, 1025, 1030, 1035, 1040, 1045, 1050, 1055, 1060, 1065, 1070, 1075, 1080, 1085, 1090, 1095, 1100, 1105, 1110, 1115, 1120, 1125, 1130, 1135, 1140, 1145, 1150, 1155, 1160, 1165, 1170, 1175, 1180, 1185, 1190, 1195, 1200, 1205, 1210, 1215, 1220, 1225, 1230, 1235, 1240, 1245, 1250, 1255, 1260, 1265, 1270, 1275, 1280, 1285, 1290, 1295, 1300, 1305, 1310, 1315, 1320, 1325, 1330, 1335, 1340, 1345, 1350, 1355, 1360, 1365, 1370, 1375, 1380, 1385, 1390, 1395, 1400, 1405, 1410, 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3075, 3080, 3085, 3090, 3095, 3100, 3105, 3110, 3115, 3120, 3125, 3130, 3135, 3140, 3145, 3150, 3155, 3160, 3165, 3170, 3175, 3180, 3185, 3190, 3195, 3200, 3205, 3210, 3215, 3220, 3225, 3230, 3235, 3240, 3245, 3250, 3255, 3260, 3265, 3270, 3275, 3280, 3285, 3290, 3295, 3300, 3305, 3310, 3315, 3320, 3325, 3330, 3335, 3340, 3345, 3350, 3355, 3360, 3365, 3370, 3375, 3380, 3385, 3390, 3395, 3400, 3405, 3410, 3415, 3420, 3425, 3430, 3435, 3440, 3445, 3450, 3455, 3460, 3465, 3470, 3475, 3480, 3485, 3490, 3495, 3500, 3505, 3510, 3515, 3520, 3525, 3530, 3535, 3540, 3545, 3550, 3555, 3560, 3565, 3570, 3575, 3580, 3585, 3590, 3595, 3600, 3605, 3610, 3615, 3620, 3625, 3630, 3635, 3640, 3645, 3650, 3655, 3660, 3665, 3670, 3675, 3680, 3685, 3690, 3695, 3700, 3705, 3710, 3715, 3720, 3725, 3730, 3735, 3740, 3745, 3750, 3755, 3760, 3765, 3770, 3775, 3780, 3785, 3790, 3795, 3800, 3805, 3810, 3815, 3820, 3825, 3830, 3835, 3840, 3845, 3850, 3855, 3860, 3865, 3870, 3875, 3880, 3885, 3890, 3895, 3900, 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DECK PLAN



ELEVATION

# ACCESSORY ORIENTATION CHART

ITEM	SERVICE	SIZE	REF. NUMBER	RADIUS	REMARKS FOR POSITION OF HOOP RING TO BE USED
1,2	DOCK NECK W/1/2" D. STUD	20"	CTR	CTR	----
	FILTER FLANGE	20"	6"	10'-18" 3/4"	----
5	150R BOLL FLANGE	4"	150"	7'-6"	----
6	150R BOLL FLANGE	4"	150"	15'-0"	----
6B	150R BOLL FLANGE	4"	1575'-10"	10'-0"	----
7	MANWAY/PRV	24"	150"	25'-0"	----
8	150R BOLL FLANGE	4"	1125'-0"	10'-0"	----
	CONCRETE SLAB	24"	25'-0"	----	----
	20" TOP FLAT MANWAY	20"	205'	SEE DETAIL	5'-6" 15/16" TO TP
	CD 3000B HALF CPLG	1/2"	----	----	H
KK	44' EXPLOSION PANEL	44" X 69"	KK	----	TOP TRING
KK	TRUCK BOLL FLANGE	4" X 1913" X	90-2130	----	GRADE
KK	INTERIOR LADDER ASSY	----	----	----	----
***	SEE C-805-11-665-03 HOPPER ASSEMBLY	----	----	----	----
***	SEE D-805-11-665-01 PLAT LAYOUT	----	----	----	----
***	SEE D-805-11-665-03 INTERIOR PLATFORM ASSY	----	----	----	----

SEE C-88-15-4663-01 HOPPER ASSEMBLY  
SEE C-88-15-4663-01 INTERIOR PLATFORM ASSY  
SEE C-88-15-4663-01 INTERIOR PLATFORM ASSY

ITEM	QTY	REF. NO.	DESCRIPTION	UNIT
1	8	00-0005-0000-7	DOCK NECK 38-59 H/L V/NECK PCHG	E/C
2	1	00-0005-0000-8	DOCK CYR W/1/2" X 1/2" LBS TUBE STOP	E/C
3	1	00-010504-0046637	DOCK 3/16" 2" DIA. DOCK GREG W/28 H. PLNG	E/C
4	1	00-010504-0046638	DOCK 3/16" 2" DIA. DOCK GREG OPLAN	E/C
5	1	00-010504-0046639	DOCK 3/16" 2" DIA. DOCK GREG W/4" FLG PCHG	E/C
6	1	00-010504-0046640	DOCK 3/16" 2" DIA. DOCK GREG W/4" FLG PCHG	E/C
7	1	00-010504-0046641	DOCK 3/16" 2" DIA. DOCK GREG W/24" H. PLNG	E/C
8	1	00-010504-0046642	DOCK 3/16" 2" DIA. DOCK GREG W/4" FLG PCHG	E/C
9	0	00-010504-0046643		N
10	1	70574000-0046646	CLS SESS HELLSTINE BIKES 4" W/2000 MRL 6' PROJ	E/C
11	1	870489W25W	NOZZLE HDW KIT W/200 2 1/2" 5" S	E/C
12	1	88370504-0046634	FLITER FLANGE 3/16" 1/2" DIA. BOLT-IN	E/C
13	1	95338R0000-00000	SPW WEND HWM KIT BBL W/EPDM GSKT	E/C
14	1	LSO-80-0048-000	HW/PRV 2" E OF PRESS-65 OZ VAC	E/C
15	1	00-010504-0046636	2 BAR 1/4" PLNG SPCL	ET
16	1	63170000-0046639	2 BAR 1/4" PLNG SPCL	ET
17	1	63170000-0046636	2 BAR 1/4" PLNG SPCL	ET
18	1	69170000-0046636	2 BAR 1/4" PLNG SPCL	ET
19	2	75WV0002	STRIP GASKET NON-REINF EPPH	N
20	1	77702004	BOLT 1/2" X 1 1/2" LBS FLN GHS	N
21	2	77502004	WASHER 1/2" X 1 1/2" LBS HDG	N
22	2	779040125	WASHER 1/2" X 1 1/2" LBS FLN GHS	N
23	1	782060000	NUT 1/2" HEX HDG	N

## REFERENCE DRAWINGS

STANDARD DETAILS FOR FINE POWDER TANKS	D-50-24-154663-01
SECTION MANUAL (CST)	C10089
HARDWARE	D-50-24-154663-01
ANCHOR BOLT LAYOUT	D-50-24-154663-01
FLAT LAYOUT	D-50-24-154663-01
HOPPER ASSEMBLY	C-88-15-4663-01
INTERIOR PLATFORM ASSY	D-50-24-154663-01
PLAT LAYOUT	D-50-24-154663-01
DECK STRUCTURE	D-50-24-154663-01

## NOTES:

- THIS TANK IS DESIGNED FOR SYMMETRICAL LOADING (CENTER DISCHARGE) UNLESS OTHERWISE SPECIFIED. SYMMETRICAL LOADING (CENTER DISCHARGE) CONFIGURATIONS MAY CAUSE A NON-SYMMETRICAL DISCHARGE PATTERN WITH CERTAIN BULK SOLIDS WHICH COULD RESULT IN STRUCTURAL DAMAGE TO THE TANK. PRECAUTIONS SHOULD BE TAKEN TO INSURE THE PRODUCT FLOWS IN A SYMMETRICAL, CENTER DISCHARGE PATTERN. CST IS NOT RESPONSIBLE FOR DAMAGE TO THE TANK AS A RESULT OF A PRODUCT FLOW PATTERN OTHER THAN THE INTENDED FLOW PATTERN. IT IS RECOMMENDED FOR LOADS FROM A DRY FREE FLOWING PRODUCT OF THE INDICATED DENSITY AND FLOW PATTERN, AND IS NOT DESIGNED FOR BRIDGING OR MASS FALLING CONDITIONS.
- DO NOT FIELD CUT ANY OPENINGS IN TANK OR APPLY LOADS TO TANK FROM EQUIPMENT OTHER THAN NOTED ON THIS DRAWING, WITHOUT APPROVAL IN WRITING BY CST STORAGE PRIOR TO INSTALLATION.
- THIS TANK IS DESIGNED AS AN ATMOSPHERIC UNIT THAT OPERATES ON AN EQUALIZED PRESSURE INTERNALLY AND EXTERNALLY. CUSTOMER IS TO ASSURE PROPER VENTILATION IS PROVIDED AND MAINTAINED.
- GROUND UNDER BASE PLATES OF COLUMNS AND ENTIRE TANK CHASSIS AS SHOWN ON ERECTION DRAWING. GROUND IS TO BE A HIGH STRENGTH NON-SHRINKING GROUT WITH A MINIMUM COMPRESSIVE STRENGTH OF 7000 PSI AT 28 DAYS, AND IS TO BE APPLIED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.
- FOR COMPLETE ERECTION DETAILS, SEE CST STORAGE'S STANDARD DRY TANK ERECTION MANUAL, C10089.
- FOR TANKS SUPPORTED ON STRUCTURAL STEEL, SHIMMING MAY BE REQUIRED BETWEEN THE TANK BASE AND STRUCTURE TO ACHIEVE COMPLETE SUPPORT. SHIMS ARE TO BE FURNISHED AND INSTALLED BY OTHERS.
- FOR TANKS WITH HOPPERS, ALLOWANCE FOR UNRESTRICTED EXPANSION AND CONTRACTION OF THE HOPPER IS REQUIRED. FLEXIBLE CONNECTIONS OR OTHER DEVICES TO BE DESIGNED, FURNISHED, AND INSTALLED BY OTHERS.

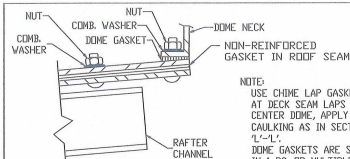
## TANK DATA

- TANK COATING: INTERIOR PRODUCT ZIND, TRICLO W/NO EP; INTERIOR SKIRT, TRICLO BOND EP; W/AVI/776-136 SURREY BEING OFFERED PERFORMANCE URETHANE; EXTERIOR SKIRT BOND EP; W/AVI/776-136 SURREY BEING OFFERED PERFORMANCE URETHANE.
- HARDWARE: GALVANIZED BOLTS W/FLAT WASHERS & HDG HEX NUTS, COMBINATION WASHERS FOR HOPPER, DECK AND TOP COVER.
- GASKETING: EPDM.

## DESIGN DATA:

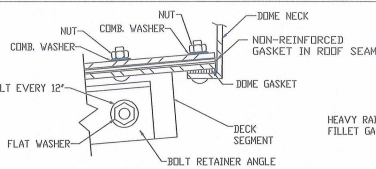
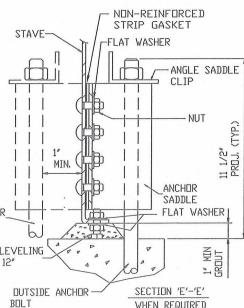
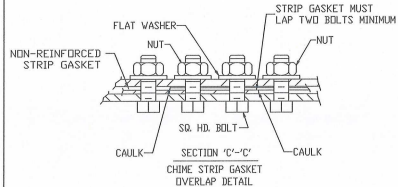
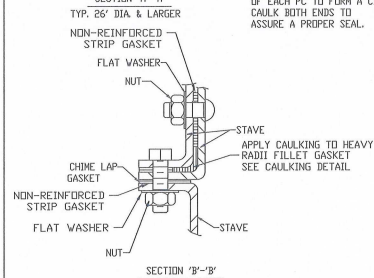
1. PRODUCT	DRIED SLUDGE
2. PRODUCT COMPACTED BULK DENSITY	70 LB./CU. FT.
3. ESTIMATED VOLUME	9,200 CU. FT. (LEVEL FULL)
4. FLOW PATTERN	FLUIDIZED FLOW
5. CENTER FILL, CENTER DISCHARGE	4.50 D/200, IN.
6. DESIGN PRESSURE POSITIVE	0.20 D/200, IN.
7. DESIGN PRESSURE NEGATIVE	0.20 D/200, IN.
8. TANK LIVE LOAD	60 LB./SQ. FT.
9. SHOW LOAD PER INCH 200/ASCE 7-10	60 LB./SQ. FT.
10. VIBR. LOAD PER INCH 200/ASCE 7-10	60 LB./SQ. FT.
11. SEISMIC PER INCH 200/ASCE 7-10	60 LB./SQ. FT.

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NOTE: USE CHIME LAP GASKETS AT DECK SEAM LAPS AT CENTER DOME, APPLY CAULKING AS IN SECTION 1'-1'.

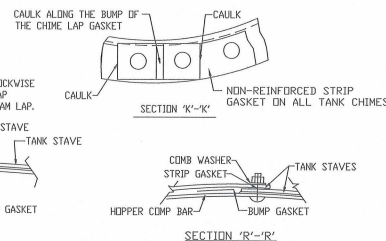
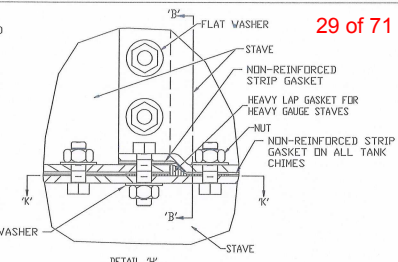
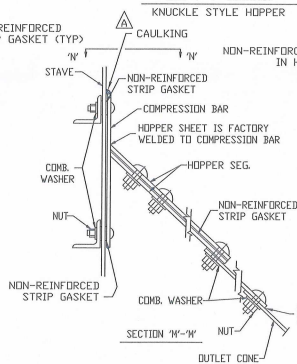
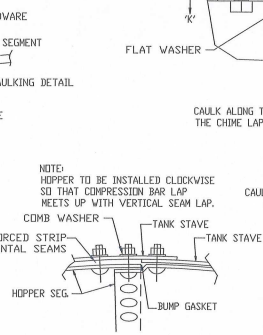
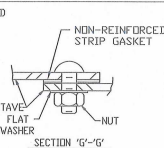
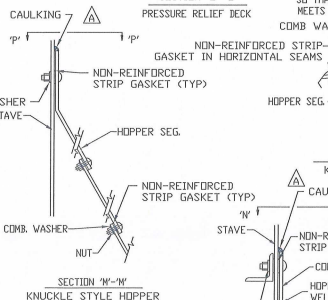
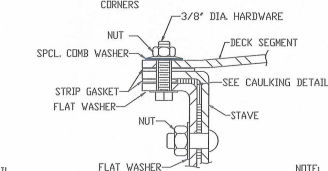
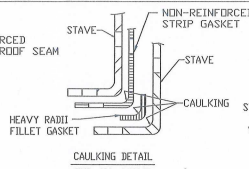
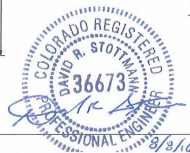
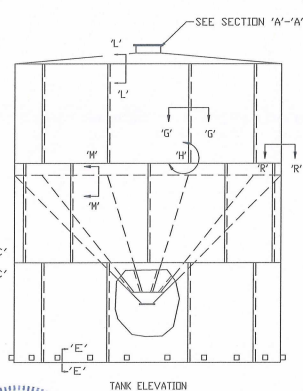
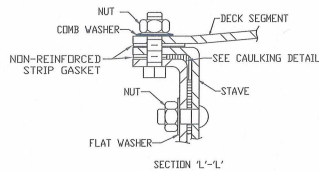
DOME GASKETS ARE SUPPLIED IN 1 PC. OR MULTIPLE PC. SETS. LAP EACH END HOLE OF EACH PC TO FORM A CIRCLE. CAULK BOTH ENDS TO ASSURE A PROPER SEAL.



SECTION 'A'-A'

TYP. 9" THRU 21" DIA. TANKS  
V/ FLANGED DECK SHEETS

NOTE: ON 18" TANKS PUT BOLT CHANNEL AT OUTER PORTION OF TANK. ONE HL IN VERT. SEAM AT DOME WILL NOT HAVE BOLT CHANNEL.



CAULKING NOTE: CAULK BETWEEN COMPRESSION BAR & STAVE, CAULK BETWEEN ALL HOPPER SEAMS. AFTER TIGHTENING REMOVE ALL EXCESS CAULKING FROM INT. OF HOPPER.

SHT 1 OF 2

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D	REVISE NOTES	KRC	KJ	DRS	10/2/13	SCALE
C	SECTION 'R'-R' ADDED	CPW	KRC	DRS	8/07/12	DRS T/M 1/18/05
B	LOGO CHANGE	CPW	KRC	DRS	1/05/11	KJ 1/25/05
A	REV. ADDED CAULKING	KJ	HE	APP.	DATE	APP. DRS 1/25/05

**CST STORAGE**

STANDARD DETAILS  
FOR  
FINE POWDER TANKS

REL. NOS.  
B 50-00-0000-21



RING # 51/15 1/2" ID			EMPELLED RING FOR RING 5		
LOCATION	DESCRIPTION	QTY		PART NAME	PRICE
VERTICAL LAP SOLTS	1/2 X 1 1/4 HD HDG 200	250	5 1/3 13	775000000	434 1/2" X 1 1/4 L X 1 1/4" SQUARE END RING
VERTICAL STEEL RAFTS	1/2 HEX NUT	760	5 1/3 13	775000000	434 1/2" X 1 1/4 L X 1 1/4" SQUARE END RING
VERTICAL STEEL RAFTS	1/2 FLAT W/EL	540	5 1/3 13	775000000	434 1/2" X 1 1/4 L X 1 1/4" SQUARE END RING
VERTICAL STEEL RAFTS	1/2 FLAT W/EL - 1 HOLE	140	5 1/3 13	775000000	434 1/2" X 1 1/4 L X 1 1/4" SQUARE END RING
CHINE LAPS	1/2 X 1 1/4 50 HD HDG GRSO	432	5 1/3 13	775000000	434 1/2" X 1 1/4 L X 1 1/4" SQUARE END RING
CHINE LAP SOLTS	1/2 FLAT W/EL HDG GRSO	432	5 1/3 13	775000000	434 1/2" X 1 1/4 L X 1 1/4" SQUARE END RING
CHINE WASHER	1/2 FLAT W/EL	432	5 1/3 13	775000000	434 1/2" X 1 1/4 L X 1 1/4" SQUARE END RING
CHINE RAFTS	1/2 HEX NUT	432	5 1/3 13	775000000	434 1/2" X 1 1/4 L X 1 1/4" SQUARE END RING
CHINE STEEL GASKET	STEEL GASKET - 1 HOLE	30	5 1/3 13	775000000	434 1/2" X 1 1/4 L X 1 1/4" SQUARE END RING
CHINE LAP GASKET	GSKT LAP GASKET	30	5 1/3 13	775000000	434 1/2" X 1 1/4 L X 1 1/4" SQUARE END RING
GASKET GASKET	GASKET GASKET	30	5 1/3 13	775000000	434 1/2" X 1 1/4 L X 1 1/4" SQUARE END RING

2 HIPPER SEGMENTS AND OUTLET CONE	
LOCATION	DESCRIPTION
COMPRESSION BAR BOLTS	1/2 X 1 1/2 FN HD HDG
SPLICE TAB BOLTS	1/2 X 2 FN HD HDG
SPLICE ANGLE BOLTS	1/2 X 2 FN HD HDG
VERT SEAM BOLTS	1/2 X 2 FN HD HDG
COMP BAR WASHERS	1/2 NEEDPINE BACKED STEEL
COMP BAR NUTS	1/2 HEX NUT
COMP BAR GSKT	STRIP GASKET - 1 HOLE
COMP BAR SPLICE	USE CHALKING SEE DETAIL
VERT SEAM - LAP GSKT	GSKT CHALK LAP STEP EPM
UPPER RADIAL SEAM BOLTS	1/2 X 1 1/4 FN HD HDG
UPPER RADIAL SEAM WASHERS	1/2 NEEDPINE BACKED STEEL
UPPER RADIAL SEAM NUTS	1/2 HEX NUT
UPPER RADIAL SEAM STRIP GSKT	STRIP GASKET - 1 HOLE

COMPILED BOM FOR HOPPER					
QTY	ENG	ITEM	UOM	PAINT	DESCRIPTION
74	-	15	-	77700802	1600 BOLT - 1/2 X 1 3/4 LBS FPM ROUND HEAD HSG
36	-	15	-	77700804	790 BOLT - 1/2 X 1 3/2 LBS FPM ROUND HEAD HSG
174	-	15	-	77700803	790 BOLT - 1/2 X 1 3/2 LBS FPM ROUND HEAD HSG
166	-	15	-	78024000	2730 WASHER - 1/2 INCH GALVANIZED
676	-	15	-	75924000	2730 WASHER - 1/2 INCH NEOPRENE BACKED GALVANIZED STEEL
960	-	16	-	751V0002	471 STRIP GASKET - 1 INCH EDPM
960	-	17	-	753V0033	34 GASKET - CHOM P LAMP HEAVY BUMP EDPM
960	-	18	-	753V0003	37 GASKET - CHOM LAMP STEP EDPM
231	-	19	-	756C0000	38 THENDRO 606 WHITE GULK

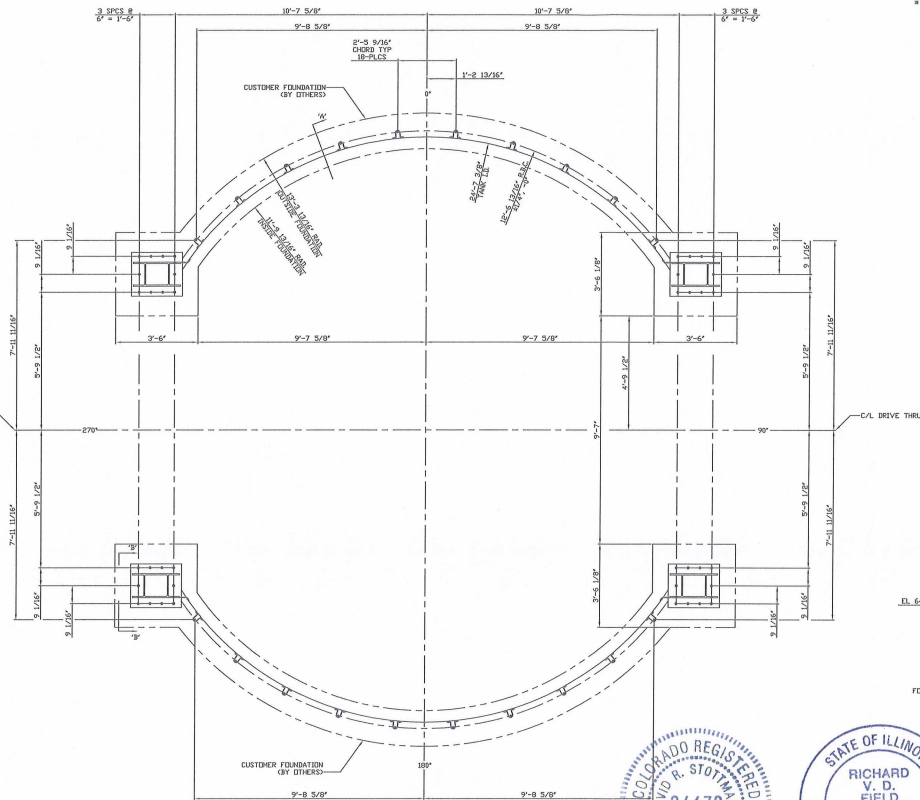
APPROVED FOR CONSTRUCTION

8/10/16  
EXP 11/30/16

TANK HARDWARE
24'-7 3/8"Ø x 52' HIGH TANK
KOMLINE SANDERSON ENGINEERING CHICAGO, IL; USA

D-50-24-154663-01

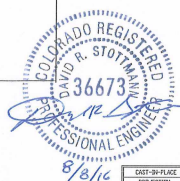
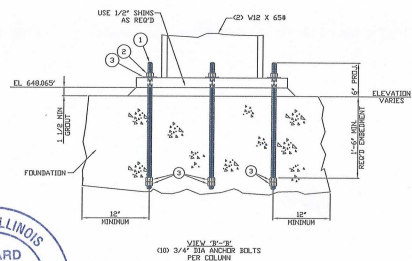
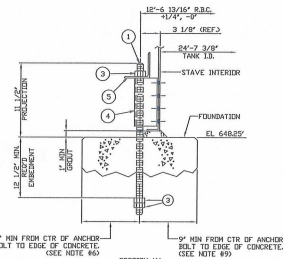
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- NOTES:
- 1) DIMENSIONS SHOWN ARE TO NEAREST 1/16".
  - 2) HAT TO BE TREATED TO MEET HAZ 1000 CONDITION. SNAUS TIGHT CAN BE OBTAINED WITH THE FULL EFFECT OF A HAT WITH AN ORDINARY SPRAY VENEER.
  - 3) HAT TO BE ADDED TO HAT AFTER COATING.
  - 4) BEFORE PLACING OF GROUT, BASE OF TANK TO BE LEVEL - 1/4" IN ANY SPOT.
  - 5) 1/4" TO BE PLACED ON TOP OF HAT.
  - 6) 1/4" TO BE PLACED ON A PLANE ON THE TOTAL CIRCUMFERENCE.
  - 7) GROUT IS TO BE HIGH STRENGTH NON-SHRINKING GROUT WITH A COMPRESSIVE STRENGTH OF 7000 PSI AT 28 DAYS.
  - 8) ANCHOR BOLT EMBEDMENT DESIGN PER ACI 308 APP D.
  - 9) CRACKED CONCRETE TO BE REPAIR WITH ANCHOR BOLT.
  - 10) TEMPORARY TIE BARS TO BE USED WHEN REINFORCEMENT REQUIRED FOR ANCHOR BOLTS.
  - 11) ANCHOR BOLT GRADE F1554 A36.
  - 12) MINORAL WEIGHT CONCRETE MINIMUM  $C_p = 4000$  PSI.
  - 13) FOR TANKS WITH STIFFENER COLLARS, ADEQUATE CONCRETE IS TO BE PLACED WITHIN COLLAR.

ITEM#	PART NO.	QTY	DESCRIPTION	PAGE
1	795ED6030	60	3/4"ALL-THREAD X 30" F1554 A36 HDN EG	31 of 5
2	791HE06000	40	3/4"VASHER, FLAT EG	
3	782EC01200	100	3/4"WUT, HEX EG	
4		20	HDG DRY ANCHOR BOLT STIRRUP BNL	
5		20	3/4"CLIP ANCHOR BOLT A36 CS	

SHIPPED WITH TANK



CAST-IN-PLACE ANCHOR BOLT TOLERANCE	
PROJECTION	$\pm 1/4"$
CHORD	$\pm 1/8"$
PLUMBNESS	3 DEG. FROM VERTICAL

REF. ACI 308

APPROVED/TIME SLOTS IF APPROVED PROVIDER OF THE SERVICE, INDICATE THE DATE OF SERVICE AND THE SERVICE PROVIDER THE SERVICE OF THE PROVIDER OF THE SERVICE THE SERVICE OF THE SERVICE OF THE SERVICE THE SERVICE OF THE SERVICE THE SERVICE OF THE SERVICE	D						DATE
	C						NTS
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	A	APPROVED FOR CONSTRUCTION	C.B.	XXX	XXX	10/00	DATE

ANCHOR BOLTS STRADDLE MAJOR C/L'S

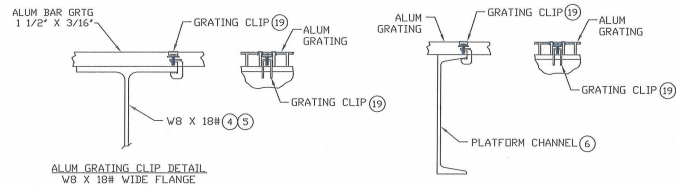


ANCHOR BOLT LAYOUT FOR 24FT DIA DRY BOLTED TANK	
NO. -4443	D-88-15-4663

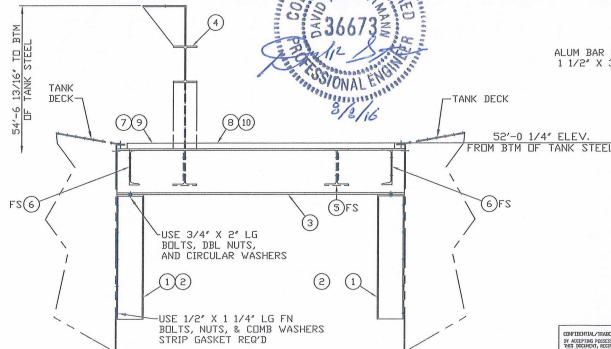
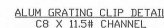


ROW	QTY	PART NDL	DESCRIPTION	PAIN
1	2	44006615-154663A	2 EXTERIOR COLUMN V6 X 158 X 27 1/8"	Z
2	2	44006615-154663B	2 EXTERIOR COLUMN V6 X 158 X 27 1/8"	Z
3	2	310G01000-154663A	2 CONVEYOR SUPT BEAM V10 X 228 X 69 13/32"	Z
4	1	310G08000-154663B	1 CONVEYOR SUPT BEAM W8 X 188 X 59 1/2"	N
5	1	310G08000-154663C	1 CONVEYOR SUPT BEAM W8 X 188 X 59 1/2"	N
6	2	310G08000-154663D	2 GRGT SUPT CHANNEL XB X 115#	N
7	1	310A0150-154663A	1 BAR GRGT ALUM 1 1/2" X 3 1/6" X 16 19/32" X 36"	N
8	1	310A0150-154663B	1 BAR GRGT ALUM 1 1/2" X 3 1/6" X 36" X 50 11/32"	N
9	1	310A0150-154663C	1 BAR GRGT ALUM 1 1/2" X 3 1/6" X 16 19/32" X 36"	N
10	1	310A0150-154663D	1 BAR GRGT ALUM 1 1/2" X 3 1/6" X 36" X 50 11/32"	N
11	42	777G00812	42 BOLT 1/2" X 1 1/4" LG FN H/G GR5	N
12	42	790204000	42 WASHER 1/2" COMBINATION	N
13	42	782G00800	42 NUT 1/2" HEX HDG	N
14	1	751V00002	1 STRIP CASKET NON-REINF EPDM	N
15	17	99-00-0202-98	17 BOLT 3/4" X 1 3/4" A325-93 TYPE 1 HDG	N
16	9	779GAI220	9 BOLT 3/4" X 2" LG A325-93 TYPE 1 HDG	N
17	26	7791G06000	26 WASHER 3/4" CIRCULAR TYPE 1 HDG	N
18	35	780GAI200	35 NUT 3/4" HEX GRADE DH A563-93 HDG	N
19	21	99-00-0017-60	21 GRGT CLIP 110G5-1C V-1 1/4" LG BOLT	N

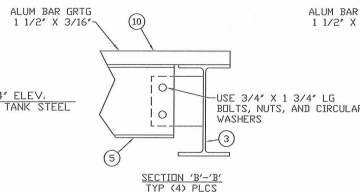
ALL 1/2" DIAMETER BOLTS  
WILL BE GRADE 5 UNLESS  
SPECIFIED OTHERWISE.



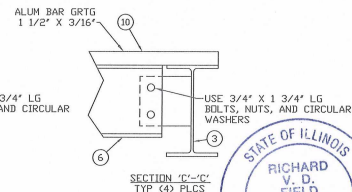
ALUM GRATING CLIP DETAIL  
W8 X 18# WIDE FLANGE



VIEW 'A'-'A'




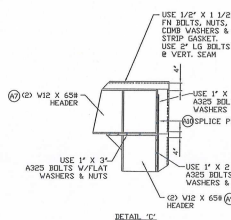
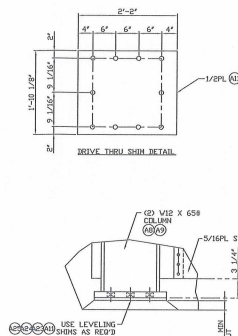
SECTION 'B'-'B'  
TYP (4) PLCS



SECTION 'C'-'C'  
TYP (4) PLCS

8/10/16  
Ex 11/30/16

CONFIDENTIAL/NOVA SUBJECTS BY ACCEPTING POSITION OF CONVEYOR, THE USER ACKNOWLEDGES THAT THE DISCLOSURE OF INFORMATION THAT RESULTS IN THE IDENTIFICATION OF THE SUBJECTS OF THE INVESTIGATION IS PROHIBITED BY LAW.	D					DATE NTS		CROSSDOVER ASSY 6'-0" WIDE W/ CONVEYOR SUPP
	C					DATE 02/29/16		
	B	APPROVED FOR CONVEYOR	SVO	BM	IRS	DATE 01/22/16		
	A	REVISED FOR RESUBMIT	CPW	CH	IRS	DATE 7/22/16		



NOTE:  
BOLT DRIVE-THRU FRAME TO  
INSIDE OF STAVE  
WITH 1/2 X 1 1/2 BOLT W/CON  
WASHER & HEX NUT.  
USE 2" BOLTS @ V.S.  
STRIP GASKET REQ'D.

CHANGED PART NUMBER ON #69	CB	KRC	DRS	7/28/16
APPROVED FOR CONSTRUCTION	CB	KRC	DRS	7/25/16
REVISED FOR RESUBMIT	CPV			5/17/16
REVISED FOR RESUBMIT	CPV			4/8/16
REVISE & RESUBMIT	BB			02/11/16



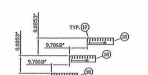
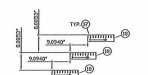
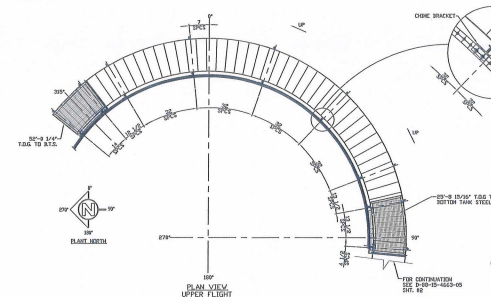
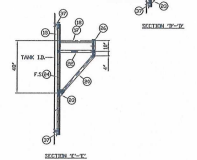
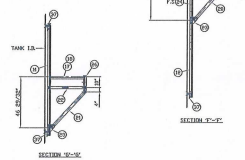
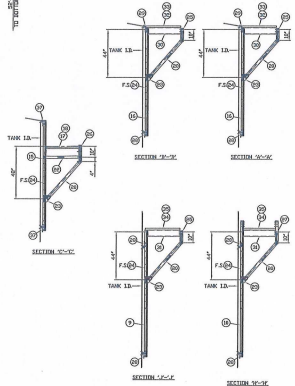
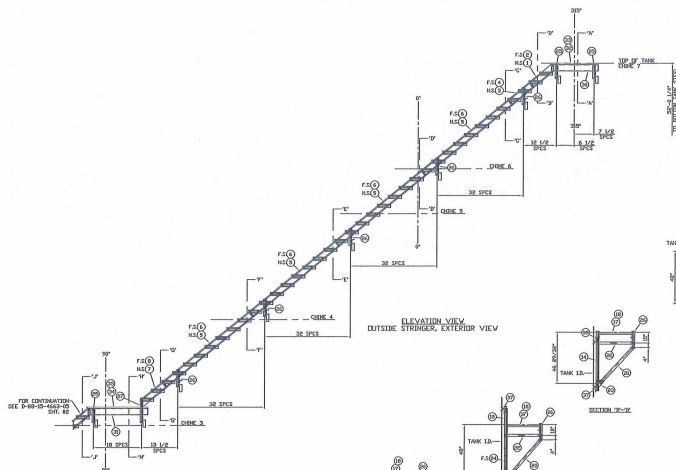
D-88-15-4663-00

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GRATING CLIP SECTION  
CS X 0.28 CHANNEL

NOTE: USE 60 CLIPS PER GRATING SECTION

ING	DIR	NO	QTY	DESCRIPTION	PART NO	PAINT
-	1	350000-154663A	1	STRENGER OUTER TOP HGA 6 X 2 7/8" X 27 7/8"		
-	1	350000-154663B	1	STRENGER INNER TOP HGA 6 X 2 7/8" X 25 5/8"		
-	1	350000-154663C	1	STRENGER OUTER MID HGA 6 X 7 1/4" X 27 3/4"		
-	1	350000-154663D	1	STRENGER INNER MID HGA 6 X 2 7/8" X 24 1/2"		
-	5	350000-154663E	4	STRENGER OUTER MID HGA 6 X 7 1/4" X 30 1/8"		
-	5	350000-154663F	4	STRENGER INNER MID HGA 6 X 2 7/8" X 28 1/2"		
-	1	350000-154663G	1	STRENGER OUTER BOTTOM HGA 6 X 7 1/4" X 30 1/8"		
-	1	350000-154663H	1	STRENGER INNER BOTTOM HGA 6 X 2 7/8" X 27 15/16"		
-	9	350000-154663I	1	VERT. SUPPORT ANGLE 1/2" X 2 1/4" X 1/4" X 16 1/2"		
-	9	350000-154663J	1	VERT. SUPPORT ANGLE 1/2" X 2 1/4" X 1/4" X 16 1/2"		
-	11	350000-154663K	1	VERT. SUPPORT ANGLE 1/2" X 2 1/4" X 1/4" X 30 1/8"		
-	11	350000-154663L	1	VERT. SUPPORT ANGLE 1/2" X 2 1/4" X 1/4" X 19 13/32"		
-	11	350000-154663M	1	VERT. SUPPORT ANGLE 1/2" X 2 1/4" X 1/4" X 30 1/8"		
-	11	350000-154663N	1	VERT. SUPPORT ANGLE 1/2" X 2 1/4" X 1/4" X 34 5/32"		
-	13	350000-154663P	1	VERT. SUPPORT ANGLE 1/2" X 2 1/4" X 1/4" X 10 1/8"		
-	13	350000-154663Q	1	VERT. SUPPORT ANGLE 1/2" X 2 1/4" X 1/4" X 9 9/32"		
-	18	35-0001-0000-19	3	STAIN TREAD WITH LIP ABSOLUTE		
-	18	35-00-0011-93	38	ALUMINUM STRAKEBARD 1/4" X 3/8" ORGT 12 X 1/4" X 30 1/8"		
-	19		0			
-	19	273000-154663E	0			
-	21	273000-154663F	2	DIAGONAL BRACE LK 1/2" X 2 1/4" X 1/4" X 46 13/16"		
-	21	350000-154663G	2	DIAGONAL BRACE LK 1/2" X 2 1/4" X 1/4" X 46 13/16"		
-	22	3500340	5	STRUT LP 2" X 2" X 1/4" X 24 5/16"		
-	23	3500341	9	STRUT BRACE CLIP 3/16"		
-	24	3500340	24	1/2" X 2 1/4" X 2 1/4" X 24 5/16" STEFFENDER		
-	25	5400000-154663A	3	STRENGER SUPPORT ANGLE LK 1/2" X 2 1/4" X 1/4" X 10"		
-	25	5400000-154663B	5	STRENGER SUPPORT ANGLE LK 1/2" X 2 1/4" X 1/4" X 15 3/4"		
-	25	5400000-154663C	3	STRENGER SUPPORT ANGLE LK 1/2" X 2 1/4" X 1/4" X 21 3/8"		
-	28	35-00-0099-59	6	CHINE BRACKET		
-	29	37800-140-14663X	2	CHINE BRACKET		
-	30	350000-154663A	1	RADIAL PLATE 5 X 8 3/8"		
-	31	350000-154663B	1	RADIAL PLATE 5 X 8 3/8"		
-	32	330400-154663A	1	PLATFOM GRD 1 1/2" X 3 1/4" ALUM		
-	33	330400-154663B	1	PLATFOM GRD 1 1/2" X 3 1/4" ALUM		
-	34	330400-154663C	1	PLATFOM GRD 1 1/2" X 3 1/4" ALUM		
-	35	330400-154663D	1	PLATFOM GRD 1 1/2" X 3 1/4" ALUM		
-	36	99-00-0017-60	16	BAR RAKE CLIP, 1705G-C W-1 1/4" LG BOLT		
-	37	350000-154663G	9	CHINE BRACKET CLIP		
-	38	350000-154663H	0	CHINE BRACKET CLIP		
-	39		0			
-	40		0			
-	41	99-07-0302-14	41	BOLT 3/16" X 1 1/4" LG IN HDG		
-	42	99-03-0133-18	160	WASHER 3/16"X 1/8" IN HDG		
-	43	99-07-0306-05	160	NUT 3/16" IN HDG		
-	44	77500081	237	BOLT 1/2" X 1 1/4" LG IN HDG		
-	45	70910122	237	NUT 1/2" X 1 1/4" LG SLAT NG		
-	46	78200000	237	1/2" X 1 1/4" HEX HDG		

IN ORDER TO MEET OSHA STANDARDS, HANDRAIL IS REQUIRED ON STAIRWAY. HANDRAIL AND TOEBOARD IS REQUIRED ON ALL PLATFORMS (HANDRAIL SYSTEM BY OTHERS)

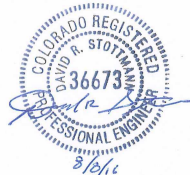
NOTES:  
1) ALL ITEMS ON THIS DRAWING TO BE GALVANIZED, EXCEPT  
TREADS, & PLATFORM GRATING WHICH ARE ALUMINUM.  
2) USE 1/2" SQ HD BOLTS AT ALL CONNECTIONS  
EXCEPT AT GRG TREADS  
3) USE 3/8" HEX HD BOLTS AT TREAD CONNECTIONS.  
4) THIS STAIR IS DESIGNED TO BE ERCTED FROM THE TOP  
WORKING DOWNWARD.

[illegible]

EXP 11/30/16 SHT. #1

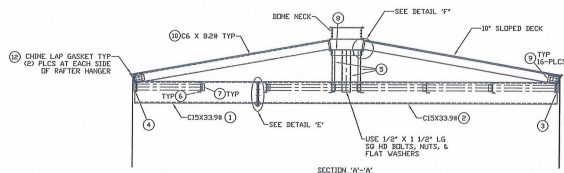
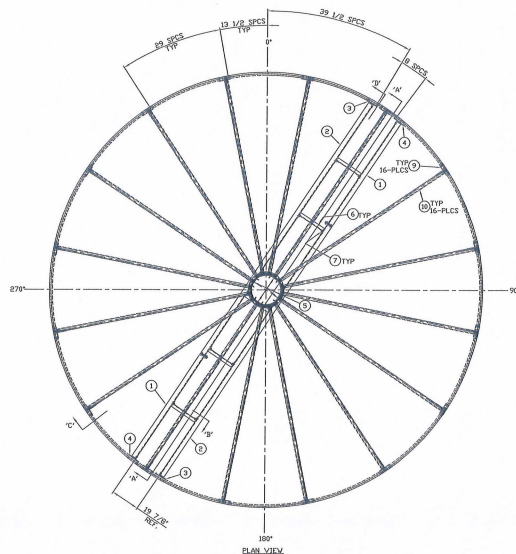
	WINDING STAIRWAY FOR 24FT DIA. BOLTED STEEL TANK	
	TEL. 781 15-4463	88-15-4663-05



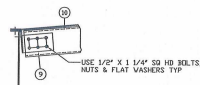


8/10/16  
EXP 11/30/16

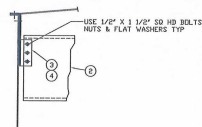
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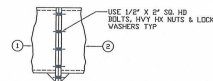
SECTION 'Y'



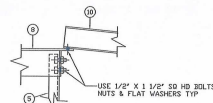
SECTION 'Z'



SECTION 'W'



DETAIL 'V'



DETAIL 'U'

NO.	PART NO.	QTY.	DESCRIPTION	UNIT
1	88-04-1480-27	2	DECK SUPT. CISK3339 X 84 11/16"	E
2	88-04-1480-26	2	DECK SUPT. CISK3339 X 17'-3 11/16"	E
3	89-04-1480-25	2	CHANNEL SUPT. CLIP LH	E
4	89-04-1480-26	2	CHANNEL SUPT. CLIP RH	E
5	4017024-15463A	4	CHIM SUPT. C6 X 0.28 X 29 3/4"	E
6	88-04-1480-39	6	TIE BRACE C7 X 9.88 X 19 1/4"	E
7	18-06-0003-00	12	TIE BRACE CLIP L&R 1/2" X 2 1/2" X 1/4 X 3/4 X 3/4	E
8	88-04-1480-24	1	CHIMER ROD	E
9	37812400-15463A	16	CHIM CLIP	E
10	40172406-15463A	16	RAFTER C6X0.28 X 19 1/4"	E
11		0		N
12	75200002	40	CHIM LAP GASKET HWY EPDM	N
13	77500002	139	BOLT 1/2" X 1 1/4" LG SD HD HDG	N
14	77500004	76	BOLT 1/2" X 1 1/2" LG SD HD HDG	N
15	77500008	21	BOLT 1/2" X 2" LG SD HD HDG	N
16	33-00-0000-23	21	WASHER 1/2" LOCK HD	N
17	77500005	230	WASHER 1/2" S&C FLAT HD	N
18	78500000	630	NUT 1/2" HEX HDG	N
19	99-00-0006-00	21	NUT 1/2" HEX BH A563 HDG	N

ALL 1/2" DIAMETER BOLTS SHALL BE GR70 UNLESS SPECIFIED OTHERWISE.



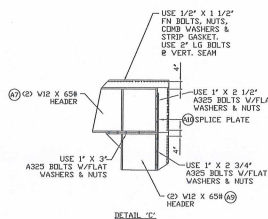
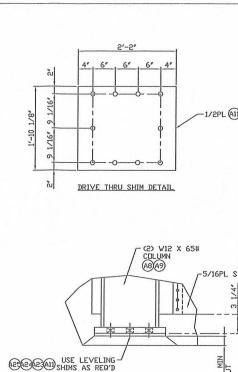
DESIGNED BY	J	CHECKED BY		DATE	NTS
DRAWN BY		IN CHARGE BY		DATE	8/10/16
APPROVED FOR CONSTRUCTION	CS	BY	NTS	DATE	8/10/16
REVIEW & REVISION	12	DATE	8/10/16	BY	8/10/16



DECK STRUCTURE ASSY  
PART 38A, 38B, 38C, 38D, 38E & 38F X 0.28 RAFTERS  
REV: 01-000  
01-000-15-6663-03







TANK STRETCH-OUT  
2.577777 INCHES PER DEGREE  
VIEWED FROM INSIDE TANK LOOKING OUT

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CRD	KRC	DATE	7/25/2006	15-4665	D-88-15-4665-00
APPR	DRP	DATE	7/26/2006		

D-88-15-4665-00

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CST Storage  
2101 S. 21st Street, P.O. Box 996  
Parsons, KS 67357  
(620) 421-0200

Pg 1 of 30

Design Calculations  
For A Dry  
Bolted Storage Tank

Customer : Komline Sanderson Engineering  
Sales Order : 15-4663-65

Tank Diameter : 24.616 Ft.  
Tank Height : 52 Ft.  
Hopper Angle : 60 Deg.  
Hopper Opening : 12.000 Ft.  
Hopper Clearance : 26.521 Ft.  
Angle of Repose : 0 Deg.  
Tank Design Volume : 9916 Cu. Ft.  
Product : Dried Sludge  
Product Bulk Density : 70 Lb./Cu.Ft.  
Mat'l Of Construction : Carbon Steel  
Wind Design : IBC 2012 ASCE 7-10  
Velocity = 120 mph  
Exposure = C

Seismic Design : IBC 2012 ASCE 7-10  
Ss = 12.70 %  
S1 = 5.80 %  
Site Class = D  
Seismic Design Category = B

Sds = 0.135  
Sd1 = 0.093  
le = 1.3  
R = 3.0  
V = 0.056 W

Deck Snow Load : IBC 2012 ASCE 7-10  
Ground Snow Load = pg = 25 psf  
ls = 1.1  
Deck Snow Load = pf = 24 psf

Deck Live Load : 20 psf  
Equipment Load : 4800 Lbs  
Design Pressure : 4.50 Oz./Sq.In.  
Design Vacuum : 0.50 Oz./Sq.In.  
Tank Support Style : Skirted

Prepared By : DRS

Reviewed By : *kn*

Date : 08/05/16

Date : 8/8/16



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8/10/16  
EXP 11/30/16

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**Snow Load**  
IBC 2012 / ASCE 7-10

**Flat Roof Snow Loads**

(Slope equal to or less than 5 degrees)

$$\text{Snow Load (Flat Roof)} = p_f = 0.7 C_e C_t I_s p_g \quad (\text{Eq. 7.3-1})$$

If  $p_g > 20$  psf then  $p_f$  Shall Not Be Less Than = 20 (Is)

Exposure Factor = $C_e$ =	1.0	(Table 7-2)
Thermal Factor = $C_t$ =	1.2	(Table 7-3)
Importance Factor = $I_s$ =	1.1	(Table 1.5-2)
Ground Snow Load = $p_g$ =	25	psf (Figure 7-1)
Minimum $p_f$ =	22	psf

$$\text{Snow Load (Flat Roof)} = p_f = 24 \text{ psf}$$

**Sloped Roof Snow Loads**

(Slope greater than 5 degrees)

$$\text{Snow Load (Sloped Roof)} = p_s = C_s p_f \quad (\text{Eq. 7.4-1})$$

$$\text{Roof Slope Factor} = C_s = 1.0 \text{ psf} \quad (\text{Figure 7-2})$$

$$\text{Snow Load (Sloped Roof)} = p_s = 24 \text{ psf}$$

WIND LOADS  
IBC 2012 / ASCE 7-10

Tank Dia. (D) = 24.616 Ft

$$F = qz G C_f A_f \quad (29.5-1)$$

Tank Ht. (h) = 52 Ft

$$F' = qz G Cf$$
$$h/D = 2.11$$
$$q_z = 0.00256 K_z K_{zt} K_d (V^2) \quad (29.3-1)$$

Risk Category = 2 (Table 1.5-1)

Velocity = 120 Mph

$$K_{zt} = \begin{bmatrix} 1.00 \end{bmatrix} \quad (26.8.2)$$

### Surface Types

Exposure	C	(26.7.3)
----------	---	----------

$$K_d = 0.95 \quad (\text{Table 26.6-1})$$

(S) Moderately Smooth

Structure Ht. = 0 Ft

$$G = 0.85 \quad (26.9-1)$$

(R) Rough

$$A_f = \text{Ring Ht} \times D$$

( D'/D >=.02 & <.08 )

(V) Very Rough

( D'/D >=.08 )

$D'$  = Depth of Protruding Elements

[illegible]

Total Base Shear = Sum of the Forces (F) = 19126 Lbs  
Overturning Moment at Base of Tank = 523375 Ft-Lbs

OTM =  $F h'$  = Overturning Moment

$r =$  Tank Radius

EVL = Equivalent Vertical Load

t = Shell Thickness

$F_b =$  Bending Stress

A = Shell Cross-Sectional Area

S = Section Modulus of Shell

$$EVL = F_b \times A, \quad F_b = OTM / \pi (r^2) (t), \quad A = 2 \pi (r) t$$

$$EVL = OTM / \pi (r^2) (t) \times 2 \pi (r) (t) = 2(OTM) / r = 4(OTM) / D$$

**Seismic Force**  
**IBC 2012 / ASCE 7-10**  
**Nonbuilding Structures Seismic Design**

Pg 4 of 30

$$V = \text{Seismic Force} = \text{Base Shear}$$

$$V = C_s W \quad (\text{Eq. 12.8-1})$$

$$C_s(1) = S_d s / (R / I) \quad (\text{Eq. 12.8-2})$$

$$S_d s = 2/3 (S_m s) = 0.135 \quad (\text{Eq. 16-39 / Eq. 11.4-3})$$

$$S_m s = F_a S_s = 0.203 \quad (\text{Eq. 16-37 / Eq. 11.4-1})$$

$$S_s = 12.7 \quad \% g \quad (\text{Fig. 1613.3.1(1) / Fig. 22-1})$$

$$F_a = 1.6 \quad (\text{Table 1613.5.3(1) / Table 11.4-1})$$

$$C_s(2) = S_d 1 / T(R / I) \quad (\text{Eq. 12.8-3})$$

$$S_d 1 = 2/3 (S_m 1) = 0.093 \quad (\text{Eq. 16-40 / Eq. 11.4-4})$$

$$S_m 1 = F_v S_1 = 0.139 \quad (\text{Eq. 16-38 / Eq. 11.4-2})$$

$$S_1 = 5.8 \quad \% g \quad (\text{Fig. 1613.3.1(2) / Fig. 22-2})$$

$$F_v = 2.4 \quad (\text{Table 1613.5.3(2) / Table 11.4-2})$$

$$T = T_a$$

$$T_a = C_t (h_n)^{3/4} \quad (\text{Eq. 12.8-7})$$

$$T_a = 0.387$$

$$C_t = 0.02$$

$$h_n = 52 \quad \text{ft}$$

$$T = 0.387$$

$$C_s(3) = 0.030 \quad (\text{Eq. 15.4-1})$$

$$C_s(4) = 0.8 S_1 / (R / I) \quad (\text{Eq. 15.4-2})$$

$$\begin{aligned} \text{Risk Category} &= 3 && (\text{Table 1604.5 / Table 1.5-1}) \\ I_e &= 1.25 && (\text{Table 1.5-2}) \\ \text{Site Class} &= D && (\text{Table 20.3-1}) \\ R &= 3 && (\text{Table 15.4-2}) \\ \text{Seismic Design Category} &= B && (\text{1613.3.5 / Table 11.6 \& 11.6-2}) \end{aligned}$$

$$W = \text{Tank} + \text{Equip.} + \text{Contents} + 20\% \text{ Snow (If } > 30 \text{ psf)} \quad (12.7.2)$$

$$\begin{aligned} C_s(1) &= 0.056 \\ C_s(2) &= 0.100 \\ C_s(3) &= 0.030 \\ C_s(4) &= 0.019 \quad (S_1 \geq 60\% g \text{ Only}) \end{aligned}$$

$$V = C_s W$$

$$V = 0.056 \quad W$$



**Seismic Loads**Pg 5 of 30

$$V = 0.056 W$$

<u>Base of Tank</u>	Elev.	0.00	Ft		
Loads		W	V	Centroid Ht.	OTM
		(Lbs)	(Lbs)	(Ft)	(Ft-Lbs)
Product (Sidewall)		484822	27365	44.72	1223878
Product (Hopper)		209304	11814	33.19	392119
Tank DL (Shell)		54389	3070	26.00	79818
Tank DL (Hopper)		5178	292	33.19	9700
Tank DL (Deck)		7942	448	52.00	23312
Equip DL (Deck)		2600	147	52.00	7631
Equip DL (Shell)		2200	124	52.00	6457
Tank DL (Skirt Platform)		12000	677	14.50	9821

Total Base Shear (V) = **43938 lbs**  
 Total Seismic Overturning Moment (OTMs) = **1752737 ft-lbs**

<u>Ring 2</u>	Elev.	8.06	Ft		
Loads		W	V	Centroid Ht.	OTM
		(Lbs)	(Lbs)	(Ft)	(Ft-Lbs)
Product (Sidewall)		484822	27365	36.66	1003312
Product (Hopper)		209304	11814	25.13	296898
Tank DL (Shell)		45228	2553	21.97	56086
Tank DL (Hopper)		5178	292	25.13	7345
Tank DL (Deck)		7942	448	43.94	19699
Equip DL (Deck)		2600	147	43.94	6448
Equip DL (Shell)		2200	124	43.94	5456
Tank DL (Skirt Platform)		12000	677	6.44	4362

Total Seismic Overturning Moment (OTMs) = **1399606 ft-lbs**

Seismic Loads  
Continued

<u>Ring 3</u>	Elev.	16.12	Ft		
Loads	W	V	Centroid Ht.	OTM	
	(Lbs)	(Lbs)	(Ft)	(Ft-Lbs)	
Product (Sidewall)	484822	27365	28.60	782746	
Product (Hopper)	209304	11814	17.07	201677	
Tank DL (Shell)	36067	2036	17.94	36522	
Tank DL (Hopper)	5178	292	17.07	4989	
Tank DL (Deck)	7942	448	35.88	16085	
Equip DL (Deck)	2600	147	35.88	5266	
Equip DL (Shell)	2200	124	35.88	4455	

Total Seismic Overturning Moment (OTMs) = **1051740 ft-lbs**

<u>Ring 4</u>	Elev.	24.18	Ft		
Loads	W	V	Centroid Ht.	OTM	
	(Lbs)	(Lbs)	(Ft)	(Ft-Lbs)	
Product (Sidewall)	484822	27365	20.54	562180	
Product (Hopper)	209304	11814	9.01	106456	
Tank DL (Shell)	26906	1519	13.91	21125	
Tank DL (Hopper)	5178	292	9.01	2634	
Tank DL (Deck)	7942	448	27.82	12472	
Equip DL (Deck)	2600	147	27.82	4083	
Equip DL (Shell)	2200	124	27.82	3455	

Total Seismic Overturning Moment (OTMs) = **712404 ft-lbs**



**Seismic Loads**  
Continued

<b><u>Ring 5</u></b>	Elev.	32.24	Ft		
<u>Loads</u>	<u>W</u>	<u>V</u>	<u>Centroid Ht.</u>	<u>OTM</u>	
	(Lbs)	(Lbs)	(Ft)	(Ft-Lbs)	
Product (Sidewall)	484822	27365	12.48	341614	
Product (Hopper)	209304	11814	0.95	11235	
Tank DL (Shell)	17746	1002	9.88	9896	
Tank DL (Hopper)	5178	292	0.95	278	
Tank DL (Deck)	7942	448	19.76	8859	
Equip DL (Deck)	2600	147	19.76	2900	
Equip DL (Shell)	2200	124	19.76	2454	

Total Seismic Overturning Moment (OTMs) = **377235** ft-lbs

<b><u>Spring Line</u></b>	Elev.	37.45	Ft		
<u>Loads</u>	<u>W</u>	<u>V</u>	<u>Centroid Ht.</u>	<u>OTM</u>	
	(Lbs)	(Lbs)	(Ft)	(Ft-Lbs)	
Product (Sidewall)	484814	27365	7.28	199122	
Tank DL (Shell)	11828	668	7.28	4858	
Tank DL (Deck)	7942	448	14.55	6524	
Equip DL (Deck)	2600	147	14.55	2136	
Equip DL (Shell)	2200	124	14.55	1807	

Total Seismic Overturning Moment (OTMs) = **214447** ft-lbs

**Seismic Loads**  
Continued

<b><u>Ring 6</u></b>	Elev.	40.30	Ft		
<u>Loads</u>		<u>W</u>	<u>V</u>	<u>Centroid Ht.</u>	<u>OTM</u>
		(Lbs)	(Lbs)	(Ft)	(Ft-Lbs)
Product (Sidewall)		389770	22000	5.85	128702
Tank DL (Shell)		8585	485	5.85	2835
Tank DL (Deck)		7942	448	11.70	5245
Equip DL (Deck)		2600	147	11.70	1717
Equip DL (Shell)		2200	124	11.70	1453

Total Seismic Overturning Moment (OTMs) = **139952 ft-lbs**

<b><u>Ring 7</u></b>	Elev.	43.94	Ft		
<u>Loads</u>		<u>W</u>	<u>V</u>	<u>Centroid Ht.</u>	<u>OTM</u>
		(Lbs)	(Lbs)	(Ft)	(Ft-Lbs)
Product (Sidewall)		268508	15156	4.03	61078
Tank DL (Shell)		6103	344	4.03	1388
Tank DL (Deck)		7942	448	8.06	3613
Equip DL (Deck)		2600	147	8.06	1183
Equip DL (Shell)		2200	124	8.06	1001

Total Seismic Overturning Moment (OTMs) = **68263 ft-lbs**

**Seismic Loads**  
Continued

<u>Ring 8</u>	Elev.	0.00	Ft		
Loads		W	V	Centroid Ht.	OTM
		(Lbs)	(Lbs)	(Ft)	(Ft-Lbs)
Product (Sidewall)		484822	27365	44.72	1223878
Product (Hopper)		209304	11814	33.19	392119
Tank DL (Shell)		54389	3070	26.00	79818
Tank DL (Hopper)		5178	292	33.19	9700
Tank DL (Deck)		7942	448	52.00	23312
Equip DL (Deck)		2600	147	52.00	7631
Equip DL (Shell)		2200	124	52.00	6457
Tank DL (Skirt Platform)		12000	677	14.50	9821

Total Seismic Overturning Moment (OTMs) = **1752737 ft-lbs**

<u>Ring 9</u>	Elev.	0.00	Ft		
Loads		W	V	Centroid Ht.	OTM
		(Lbs)	(Lbs)	(Ft)	(Ft-Lbs)
Product (Sidewall)		484822	27365	44.72	1223878
Product (Hopper)		209304	11814	33.19	392119
Tank DL (Shell)		54389	3070	26.00	79818
Tank DL (Hopper)		5178	292	33.19	9700
Tank DL (Deck)		7942	448	52.00	23312
Equip DL (Deck)		2600	147	52.00	7631
Equip DL (Shell)		2200	124	52.00	6457
Tank DL (Skirt Platform)		12000	677	14.50	9821

Total Seismic Overturning Moment (OTMs) = **1752737 ft-lbs**

**Seismic Loads**  
Continued

<u>Ring 10</u>	Elev.	0.00	Ft		
Loads		W	V	Centroid Ht.	OTM
		(Lbs)	(Lbs)	(Ft)	(Ft-Lbs)
Product (Sidewall)		484822	27365	44.72	1223878
Product (Hopper)		209304	11814	33.19	392119
Tank DL (Shell)		54389	3070	26.00	79818
Tank DL (Hopper)		5178	292	33.19	9700
Tank DL (Deck)		7942	448	52.00	23312
Equip DL (Deck)		2600	147	52.00	7631
Equip DL (Shell)		2200	124	52.00	6457
Tank DL (Skirt Platform)		12000	677	14.50	9821

Total Seismic Overturning Moment (OTMs) = **1752737 ft-lbs**

<u>Ring 11</u>	Elev.	0.00	Ft		
Loads		W	V	Centroid Ht.	OTM
		(Lbs)	(Lbs)	(Ft)	(Ft-Lbs)
Product (Sidewall)		484822	27365	44.72	1223878
Product (Hopper)		209304	11814	33.19	392119
Tank DL (Shell)		54389	3070	26.00	79818
Tank DL (Hopper)		5178	292	33.19	9700
Tank DL (Deck)		7942	448	52.00	23312
Equip DL (Deck)		2600	147	52.00	7631
Equip DL (Shell)		2200	124	52.00	6457
Tank DL (Skirt Platform)		12000	677	14.50	9821

Total Seismic Overturning Moment (OTMs) = **1752737 ft-lbs**

EQUIVALENT VERTICAL LOADS

Tank Diameter = 24.616 ft

M = OTM, Overturning Moment Due To Wind Or Seismic

EVL = Equivalent Vertical Load

Fb = Bending Stress

S = Section Modulus Of Circular Shell

t = Shell Thickness

R = Shell Radius

A = Area Of Circular Shell

D = Diameter Of Shell

Shell:

M = SUM (F H)

 $F_b = M / S = M / (\pi R^2 t)$ ,  $A = \pi R^2 t$ EVL =  $F_b A$  $EVL = (M / (\pi R^2 t)) (\pi R^2 t) = 2 M / R = 4 M / D$ 

Elev. ft	OTM Wind ft-lbs	EVL Wind lbs	OTM Seismic ft-lbs	EVL Seismic lbs
0.00	523375	85046	1752737	284813
8.06	379707	61701	1399606	227430
16.12	257159	41787	1051740	170904
24.18	156760	25473	712404	115763
32.24	80143	13023	377235	61299
37.45	43846	7125	214447	34847
40.30	28459	4624	139952	22742
43.94	13552	2202	68263	11092

COMBINED SEISMIC FORCES

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E = Combined effect of horizontal and vertical earthquake induced forces

Qe = Seismic EVL

D+P+EQ = Dead Load + Product Load (Below Hopper Only) + Equip Load

Sds = 0.135

E = Eh + Ev (Eq. 12.14 - 3)

Eh = Qe (Eq. 12.14 - 5)

Ev = 0.2 x Sds x D+P+EQ (Eq. 12.14 - 6)

Where the effects of gravity and the seismic ground motions are additive

Elevation (ft)	Qe (lbs)	D+P+EQ (lbs)	E (lbs)
0.00	284813	778435	305903
8.06	227430	769274	248273
16.12	170904	748113	191172
24.18	115763	738952	135783
32.24	61299	729792	81072
37.45	34847	24570	35512
40.30	22742	21327	23319
43.94	11092	18845	511

E = Eh - Ev (Eq. 12.14 - 4)

Eh = Qe (Eq. 12.14 - 5)

Ev = 0.2 x Sds x D+P+EQ (Eq. 12.14 - 6)

Where the effects of gravity and the seismic ground motions are counteractive

Elevation (ft)	Qe (lbs)	D+P+EQ (lbs)	E (lbs)
0.00	284813	778435	263722

**SHELL LOADS FROM PRODUCT**

Ref: Jenike, A.W., Effect Of Solid Flow Properties And Hopper Configuration On Silo Loads

D = Tank Diameter = 24.616 ft  
 w = Product Design Bulk Density = 70 pcf  
 Angle of Repose = 0 deg  
 Repose Centroid from Top of Shell = 0.00 ft  
 k = Ratio of Horizontal to Vertical Pressure in Cylinder = 0.4  
 (k = 0.4 for Funnel Flow -or- k = 0.6 for Mass Flow)  
 u' = Max Coeff of Friction Between Soil and Tank Sidewall = Tan 21 deg = 0.384  
 u = Min Coeff of Friction Between Soil and Tank Sidewall = Tan 5 deg = 0.087

q = Vertical Pressure =  $w D [1 - (\exp(-4 k u' Z / D))] / (4 k u)$   
 p = Lateral (Hoop) Pressure = k q  
 Lateral Load =  $p (D / 2) / 12$   
 Vertical Load =  $(w D Z / 4) - \{(w D^2) [1 - (\exp(-4 k u' Z / D))] / (16 k u)\}$

Ring Depth (ft)	Product Depth Z (ft)	Vertical Pressure q (psf)	Lateral (Hoop) Pressure p (psf)	Lateral Load (lb/in)	Bolt Load (lb/2in)	Vertical Load (lb/ft)	Total Vertical Load (lbs)
8.06	8.06	551	221	226.2	452	327	25276
11.70	11.70	792	317	325.1	650	669	51737
14.55	14.55	978	391	401.1	802	1012	78267

**HOPPER DESIGN**Pg 14 of 30

## Fluidized Flow In Hopper

Ref: Jenike, A.W., Effect Of Solid Flow Properties And Hopper Configuration On Silo Loads

Tank Diameter (D) =	24.616 ft	Const. Mat. (C, S, A) =	<input type="text" value="C"/>
Hopper Outlet Diameter (d) =	12.000 ft		
Hopper Slope From Horz. (O) =	60 deg		
Hopper Slope From Vert. (o) =	30 deg		
Hopper Height To Apex (h) =	21.32 ft		
Hopper Height (H) =	10.93 ft		
Product Wt. (w) =	70 pcf		
Fluidized Product Wt. (wf) = 0.6 w =	42 pcf		
Head Ht. of Product (Z) =	14.55 ft		
Area (A) =	476 ft <sup>2</sup>		
Volume (V) =	2990 ft <sup>3</sup>		
k (For Funnel Flow) =	0.4		
50% Internal Pressure (Pt) =	0.14 psi =	2.25 oz/in <sup>2</sup>	
Equipment Load (E) =	0 lbs		

**Analyzed At Springline**

u = Coeff. Of Friction Between Solid And Hopper Wall = Tan 5 deg =	0.087
Vertical Pressure (q) = {w D [1-(exp(-4kuZ/D))] / (4 k u)} + (144 Pt) =	998 psf
Lateral Pressure (p) = k q =	399 psf
Pressure Caused By Solid In Hopper (q1) = w V / A =	440 psf
Total Vertical Pressure (q2) = q + q1 =	1438 psf
Vertical Load (qv) = [(q2 A) + E] / (Pi D) / 12 =	737 lbs/in
Horizontal Load (qh) = qv / Tan O =	426 lbs/in

**Compression Area Design**

Shell Thickness =	0.3125 in	Inner Compression Bar Thickness =	0.25 in
Shell Fy (FyS) =	40000 psi	Inner Compression Bar Height =	12 in
Hopper Thickness =	0.1875 in	Outer Compression Bar Thickness =	0 in
Hopper Fy (FyH) =	40000 psi	Outer Compression Bar Height =	0 in
		Compression Bar Fy (FyC) =	40000 psi

Effective Shell Compression Area (As) =	6.25 in <sup>2</sup>
Effective Hopper Compression Area (Ah) =	0.56 in <sup>2</sup>
Compression Bar Area (Ac) =	3.00 in <sup>2</sup>

Total Compression Area = 9.8125 in<sup>2</sup>

Hoop Compressive Load (qc) = qh (D/2) 12 = 62873 lbs

Allow. Hoop Compressive Load = (As 0.5 Fys) + (Ah 0.5 FyH) + (Ac 0.5 FyC) = 196250 lbs OK



HOPPER DESIGN (Cont.)Pg 15 of 30Compression Area Design  
(Continued)Compression Area Bolts

# Row = 2 Bolt Diameter = 0.500 in  
 Bolt Fu = 120000 psi Bolt Area (Ab) = 0.196 in<sup>2</sup>

Combined Tension & Shear

Shear / Bolt (Vb) = 2 (qv) / # Row = 737 lbs  
 Shear Stress (fv) = Vb / Ab = 3755 psi  
 Allowable Shear Stress (Fv) = 0.17 Fu = 20400 psi

Top of Hopper to Top Compression Bar Bolt (a) = 2.656 in  
 Vertical Spacing of Compression Bar Bolts (l) = 10.000 in

Allow. Hoop Compressive Load (Hopper & Internal Comp. Bar) = (ALhc)  
 Internal Comp. Bar Area (Aci) = 3.00 in<sup>2</sup>  
 ALhc = (Ah 0.5 FyH) + (Aci 0.5 FyC) = 71250 lbs  
 Tension / Bolt (Tb) = 2 ((qh - (ALhc / (D/2) 12)) (l-a) / l) = 0 lbs  
 Tension Stress (ft) = Tb / Ab = 0 psi  
 Allowable Tension Stress (Ft) = 0.43Fu - 1.8fv <= 0.33Fu = 39600 psi

Analyzed Vertical Height Down From Springline (z) = 1 ft

Slope Distance From Top Of Hopper = 1.15 ft  
 Radius Normal To Hopper (r) = 13.55 ft  
 Hopper Diameter (D') = 23.461 ft  
 Hopper Area (A') = 432 ft<sup>2</sup>

Hopper Volume Below (V') = 2536 ft<sup>3</sup>

Hopper Thickness (t) = 0.1875 in Hopper Yield Stress (Fy) = 40000 psi

Radial Bolts (Hoop Tension)

# Row = 1 Bolt Fu = 120000 psi Full Shank (Y/N) = N

Radial Tension Design (T1)

Vertical Pressure (p') = q + (wf z) + (144 Pt) = 1060 psf  
 Pressure Caused By Fluidized Product In Hopper Below (q1') = wf V' / A' = 246 psf  
 Total Vertical Pressure (q2') = p' + q1' = 1307 psf  
 Vertical Load (qv') = (((q2' A') + E) / (Pi D')) / 12 = 639 lbs/in  
 T1 = qv' / Sin O = 737 lbs/in  
 Actual Stress = T1 / t = 3933 lbs  
 Allowable Stress = 0.4 Fy = 16000 lbs

Hoop Tension Design (T2)

T2 = (p' r) / 12 = 1197 lbs/in  
 Actual Radial Bolt Load = T2 x 2in = 2394 lbs  
 Allowable Radial Bolt Load = 3938 lbs

**HOPPER DESIGN (Cont.)**Pg 16 of 30

Analyzed Vertical Height Down From Springline (z) = 2.60 ft  
 Slope Distance From Top Of Hopper = 3.00 ft  
 Radius Normal To Hopper (r) = 12.48 ft  
 Hopper Diameter (D') = 21.616 ft  
 Hopper Area (A') = 367 ft<sup>2</sup>  
 Hopper Volume Below (V') = 1898 ft<sup>3</sup>  
 Hopper Thickness (t) = 0.1875 in      Hopper Yield Stress (Fy) = 40000 psi

Horz. Bolts (Radial Tension)  
 # Row = 1      Bolt Fu = 120000 psi      Full Shank (Y/N) = N  
Radial Bolts (Hoop Tension)  
 # Row = 1      Bolt Fu = 120000 psi      Full Shank (Y/N) = N

Radial Tension Design (T1)

Vertical Pressure (p') = q + (wf z) + (144 Pt) = 1127 psf  
 Pressure Caused By Fluidized Product In Hopper Below (q1') = wf V' / A' = 217 psf  
 Total Vertical Pressure (q2') = p' + q1' = 1345 psf  
 Vertical Load (qv') = (((q2' A') + E) / (Pi D')) / 12 = 606 lbs/in  
 T1 = qv' / Sin O = 699 lbs/in  
 Actual Horz. Bolt Load = T1 x 2in = 1398 lbs  
 Allowable Horz. Bolt Load = 3938 lbs

Hoop Tension Design (T2)

T2 = (p' r) / 12 = 1172 lbs/in  
 Actual Radial Bolt Load = T2 x 2in = 2345 lbs  
 Allowable Radial Bolt Load = 3938 lbs

Analyzed Vertical Height Down From Springline (z) = 10.06 ft  
 Slope Distance From Top Of Hopper = 11.62 ft  
 Radius Normal To Hopper (r) = 7.51 ft  
 Hopper Diameter (D') = 13.000 ft  
 Hopper Area (A') = 133 ft<sup>2</sup>  
 Hopper Volume Below (V') = 106 ft<sup>3</sup>  
 Hopper Thickness (t) = 0.25 in      Hopper Yield Stress (Fy) = 40000 psi

Horz. Bolts (Radial Tension)  
 # Row = 1      Bolt Fu = 120000 psi      Full Shank (Y/N) = N  
Radial Bolts (Hoop Tension)  
 # Row = 1      Bolt Fu = 120000 psi      Full Shank (Y/N) = N

Radial Tension Design (T1)

Vertical Pressure (p') = q + (wf z) + (144 Pt) = 1441 lbs/in  
 Pressure Caused By Fluidized Product In Hopper Below (q1') = wf V' / A' = 34 psf  
 Total Vertical Pressure (q2') = p' + q1' = 1474 psf  
 Vertical Load (qv') = (((q2' A') + E) / (Pi D')) / 12 = 399 lbs/in  
 T1 = qv' / Sin O = 461 lbs/in  
 Actual Horz. Bolt Load = T1 x 2in = 922 lbs  
 Allowable Horz. Bolt Load = 4257 lbs

Hoop Tension Design (T2)

T2 = (p' r) / 12 = 901 lbs/in  
 Actual Radial Bolt Load = T2 x 2in = 1802 lbs  
 Allowable Radial Bolt Load = 4257 lbs

**ALLOWABLE VERTICAL LOADS**Pg 17 of 30

Allowable Loads Are Based on Data From  
Baker's Structural Analysis Of Shells, Pg. 230

Tank Diameter = 24.616 ft

Material: Carbon Steel

Nominal Sheet/Plate Designation	t (in)	S (psi)	Critical (lbs)	S.F. = 2.0 (lbs)	S.F. = 2.5 (lbs)	S.F. = 3.0 (lbs)
12GA	0.1046	2325	225639	112819	90255	75213
10GA	0.1345	3433	428543	214272	171417	142848
9GA	0.1495	4046	561294	280647	224518	187098
8GA	0.1644	4687	715066	357533	286026	238355
3/16PL	0.1875	5740	998773	499387	399509	332924
7/32PL	0.2188	7268	1475843	737921	590337	491948
1/4PL	0.2500	8894	2063312	1031656	825325	687771
5/16PL	0.3125	12405	3597320	1798660	1438928	1199107
3/8PL	0.3750	16196	5636185	2818093	2254474	1878728
1/2PL	0.5000	24424	11332664	5666332	4533066	3777555

$S = Y C_c E t / R$ , Formula For Critical Buckling Stress (psi)

$Y =$  Theoretical Value For Buckling Coefficient =  $1 - (0.901(1 - (\exp(-1/16 (R/t)^{0.5})))$

$t =$  Thickness Of Shell (in)

Critical =  $2 S \pi R t$ , Total Critical Vertical Shell Load (lbs)

Critical Buckling Stress (S), Cannot Exceed 40000 psi

$C_c = 1 / [3 (1 - u^2)]^{0.5} = 0.6116$

Modulus Of Elasticity (E) = 29000000 psi

Inside Radius Of Shell (R) = 147.7 in

Poisson's Ratio (u) = 0.33

Safety Factors For Shell Buckling:

2.0...H x D < 1000 Above Hopper

2.5...H x D >= 1000 Above Hopper

3.0...Below Hopper

Shell LoadsIBC 2012 Basic Load Combinations  
(1605.3.1)

DL + Lp + Le	(Equation 16-9)
DL + 0.75Lp + 0.75Le + 0.75(Lr or S)	(Equation 16-11)
DL + 0.75Lp + 0.75Le + 0.75(Lr or S) + 0.75(0.6W)	(Equation 16-13)
DL + 0.75Lp + 0.75Le + 0.75(Lr or S) + 0.75(0.7E)	(Equation 16-14)

Shell Height = 8.06 ft

	IBC 2012				
	(16-9)	(16-11)	(16-13)	(16-14)	
Equip + Tank Dead Load = DL = 18845	18845	18845	18845	18845	
Product Load = Lp = 25276	25276	18957	18957	18957	
Equip or Platform Live Load = Le = 0	0	0	0	0	
Deck Live Load = Lr = 9518	0	0	0	0	
Deck Snow Load = S = 11422	0	8566	8566	8566	
Wind Load = W = 2202	0	0	991	0	
Combined Earthquake Load = E = 511	0	0	0	268	
Total =	44121	46369	47360	46637	Lbs

H x D = 198

Shell = 3/16 pl  
 Stiffener = N/R  
 Rows of Bolts = 1 Row Gr 5

Allowable Vertical Load = 499387 lbs  
 Actual Bolt Load = 452 lbs / 2 in  
 Allowable Bolt Load = 4260 lbs / 2 in

Shell Height = 11.70 ft

	IBC 2012				
	(16-9)	(16-11)	(16-13)	(16-14)	
Equip + Tank Dead Load = DL = 21327	21327	21327	21327	21327	
Product Load = Lp = 51737	51737	38803	38803	38803	
Equip or Platform Live Load = Le = 0	0	0	0	0	
Deck Live Load = Lr = 9518	0	0	0	0	
Deck Snow Load = S = 11422	0	8566	8566	8566	
Wind Load = W = 4624	0	0	2081	0	
Combined Earthquake Load = E = 23319	0	0	0	12243	
Total =	73064	68696	70777	80939	Lbs

H x D = 288

Shell = 3/16 pl  
 Stiffener = N/R  
 Rows of Bolts = 1 Row Gr 5

Allowable Vertical Load = 499387 lbs  
 Actual Bolt Load = 650 lbs / 2 in  
 Allowable Bolt Load = 3938 lbs / 2 in

Shell LoadsPg 19 of 30

Shell Height =	14.55 ft	Springline IBC 2012			
		(16-9)	(16-11)	(16-13)	(16-14)
Equip + Tank Dead Load = DL =	24570	24570	24570	24570	24570
Product Load = Lp =	78267	78267	58700	58700	58700
Equip or Platform Live Load = Le =	0	0	0	0	0
Deck Live Load = Lr =	9518	0	0	0	0
Deck Snow Load = S =	11422	0	8566	8566	8566
Wind Load = W =	7125	0	0	3206	0
Combined Earthquake Load = E =	35512	0	0	0	18644
Total =		102837	91836	95043	110480
H x D =	358	Lbs			

Shell =	5/16 pl	Allowable Vertical Load =	1798660	lbs
Stiffener =	N/R	Actual Bolt Load =	802	lbs / 2 in
Rows of Bolts =	1 Row Gr 5	Allowable Bolt Load =	4260	lbs / 2 in

Shell Height =	19.76 ft	IBC 2012			
		(16-9)	(16-11)	(16-13)	(16-14)
Equip + Tank Dead Load = DL =	35666	35666	35666	35666	35666
Product Load = Lp =	694126	694126	520594	520594	520594
Equip or Platform Live Load = Le =	0	0	0	0	0
Deck Live Load = Lr =	9518	0	0	0	0
Deck Snow Load = S =	11422	0	8566	8566	8566
Wind Load = W =	13023	0	0	5860	0
Combined Earthquake Load = E =	81072	0	0	0	42563
Total =		729792	564827	570687	607389
H x D =	486	Lbs			

Shell =	5/16 pl	Allowable Vertical Load =	1199107	lbs
Stiffener =	N/R	Actual Bolt Load =	0	lbs / 2 in
Rows of Bolts =	1 Row Gr 5	Allowable Bolt Load =	4260	lbs / 2 in

Shell Height =	27.82 ft	IBC 2012			
		(16-9)	(16-11)	(16-13)	(16-14)
Equip + Tank Dead Load = DL =	44827	44827	44827	44827	44827
Product Load = Lp =	694126	694126	520594	520594	520594
Equip or Platform Live Load = Le =	0	0	0	0	0
Deck Live Load = Lr =	9518	0	0	0	0
Deck Snow Load = S =	11422	0	8566	8566	8566
Wind Load = W =	25473	0	0	11463	0
Combined Earthquake Load = E =	135783	0	0	0	71286
Total =		738952	573987	585450	645274
H x D =	685	Lbs			

Shell =	5/16 pl	Allowable Vertical Load =	1199107	lbs
Stiffener =	N/R	Actual Bolt Load =	0	lbs / 2 in
Rows of Bolts =	1 Row Gr 5	Allowable Bolt Load =	4260	lbs / 2 in

Shell LoadsPg 20 of 30

Shell Height = 35.88 ft

		IBC 2012			
		(16-9)	(16-11)	(16-13)	(16-14)
Equip + Tank Dead Load = DL =	53987	53987	53987	53987	53987
Product Load = Lp =	694126	694126	520594	520594	520594
Equip or Platform Live Load = Le =	0	0	0	0	0
Deck Live Load = Lr =	9518	0	0	0	0
Deck Snow Load = S =	11422	0	8566	8566	8566
Wind Load = W =	41787	0	0	18804	0
Combined Earthquake Load = E =	191172	0	0	0	100366
Total =		748113	583148	601952	683514

Lbs

H x D = 883

Shell = 5/16 pl  
 Stiffener = N/R  
 Rows of Bolts = 1 Row Gr 5

Allowable Vertical Load = 1199107 lbs  
 Actual Bolt Load = 0 lbs / 2 in  
 Allowable Bolt Load = 4260 lbs / 2 in

Shell Height = 43.94 ft

		IBC 2012			
		(16-9)	(16-11)	(16-13)	(16-14)
Equip + Tank Dead Load = DL =	75148	75148	75148	75148	75148
Product Load = Lp =	694126	694126	520594	520594	520594
Equip or Platform Live Load = Le =	47591	47591	35693	35693	35693
Deck Live Load = Lr =	9518	0	0	0	0
Deck Snow Load = S =	11422	0	8566	8566	8566
Wind Load = W =	61701	0	0	27765	0
Combined Earthquake Load = E =	248273	0	0	0	130343
Total =		816865	640002	667767	770345

Lbs

H x D = 1082

Shell = 5/16 pl  
 Stiffener = N/R  
 Rows of Bolts = 1 Row Gr 5

Allowable Vertical Load = 1199107 lbs  
 Actual Bolt Load = 0 lbs / 2 in  
 Allowable Bolt Load = 4260 lbs / 2 in

Shell Height = 52.00 ft

		Base of Tank IBC 2012			
		(16-9)	(16-11)	(16-13)	(16-14)
Equip + Tank Dead Load = DL =	84309	84309	84309	84309	84309
Product Load = Lp =	694126	694126	520594	520594	520594
Equip or Platform Live Load = Le =	47591	47591	35693	35693	35693
Deck Live Load = Lr =	9518	0	0	0	0
Deck Snow Load = S =	11422	0	8566	8566	8566
Wind Load = W =	85046	0	0	38271	0
Combined Earthquake Load = E =	305903	0	0	0	160599
Total =		826026	649163	687434	809762

Lbs

H x D = 1280

Shell = 5/16 pl  
 Stiffener = N/R  
 Rows of Bolts = 1 Row Gr 5

Allowable Vertical Load = 1199107 lbs  
 Actual Bolt Load = 0 lbs / 2 in  
 Allowable Bolt Load = 4260 lbs / 2 in

**DRIVE THRU DESIGN**

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Tank Diameter = 24.616 ft  
 Drive Thru Width = 12.083 ft  
 Drive Thru Height = 14.000 ft  
 Drive Thru Column Depth = 1.010 ft

Shell Opng. (Arc) = 15.018 ft  
 Shell Opng. (Chord) = 14.104 ft  
 Opng. In Shell = 69.913 deg  
 Chord Height = 26.646 in

**Skirt Loads**

Ps = Total Static Skirt Load = 826026 lbs (Load Comb. (16-9))  
 Pdw = Total Wind Dynamic Skirt Load = 687434 lbs (Load Comb. (16-13))  
 Pds = Total Seismic Dynamic Skirt Load = 809762 lbs (Load Comb. (16-14))  
 ws = (Ps / Circ) (Arc / Chord) = 11374 lbs/ft  
 wdw = (Pdw / Circ) (Arc / Chord) = 9466 lbs/ft  
 wds = (Pds / Circ) (Arc / Chord) = 11150 lbs/ft  
 Vmw = Factored Wind Base Shear = 11476 lbs (0.6 x Base Shear)  
 Vms = Factored Seismic Base Shear = 30757 lbs (0.7 x Base Shear)  
 Utw = Max. Total Wind Uplift = 3322 lbs (Load Comb. (16-15))  
 Uts = Max. Total Seismic Uplift = 0 lbs (Load Comb. (16-22))  
 wuw = (Utw / Circ) (Arc / Chord) = 46 lbs/ft  
 wus = (Uts / Circ) (Arc / Chord) = 0 lbs/ft

**Header** Qty : 2 W 12 x 65 Mat'l Gr: A992

Max. Bending Stress = 9455 psi <= 0.6 Fy : 30 ksi  
 Max. Shear Stress = 8474 psi <= 0.4 Fy : 20 ksi

**Column** Qty : 2 W 12 x 65 Mat'l Gr: A992

Max. Stress Factor = 0.31 <= 1.0 (H1-1)  
 Max. Stress Factor = 0.34 <= 1.0 (H1-2)

**Top Plate** Size: 0.75 x 24.000 x 19.625 Mat'l Fy = 50 ksi

Column to Base Plate Weld (Groove) = 0 in  
 Column to Top Plate Weld (Fillet) = 0.375 in

**Gusset** Size: 0.5 x 7.250 x 7.250 Mat'l Fy = 36 ksi

**Splice Plate** Size: 0.5 x 20.000 x 24.250 Mat'l Fy = 36 ksi

**Bolt** Qty : 22 Size: 1 Dia. Bolt Gr: A325

**Web Stiffener** Web Stiffener or Doubler Not Required

**Base Plate** Size: 1.25 x 22.125 x 26.000 Mat'l Fy = 50 ksi

Column to Base Plate Weld (Groove) = 0 in  
 Column to Base Plate Weld (Fillet) = 0.375 in

Min. Distance to Edge of Concrete (Perpendicular) = 0.000 in (From Edge of Base PL)  
 Min. Distance to Edge of Concrete (Parellel) = 0.000 in (From Edge of Base PL)

**Anchor Bolt** Qty : 10 Size: 0.75 Dia. Length: 24 Mat'l Gr: A36 All Thread

Min. Distance to Edge of Concrete (Perpendicular) = 9.845 in (From CL of Anchor Bolt)  
 Min. Distance to Edge of Concrete (Parellel) = 9.845 in (From CL of Anchor Bolt)  
 Projection = 6 in  
 Embedment = 18 in



**BOLTED DECK DESIGN**Pg 22 of 30**Self Support**

Tank Diameter =	24.616 ft	Material Type (C,S or A) =	C
Center Rafter Ring Diameter =	20 in		
Number of Deck Segments = n =	16	Pressure Load =	4.50 oz/in <sup>2</sup> = 40.5 psf
Deck Slope (1:12 = 4.7636) =	10 deg	Vacuum Load =	0.50 oz/in <sup>2</sup> = 4.5 psf
Equipment Load = P =	2600 lbs	Total Load = DL + LL =	35.0 psf
LL = Deck Live Load or Deck Snow Load =	24 psf	Total Load = DL + VL =	15.5 psf
Dead Load (Deck Sheet + Rafters) = DL =	11.0 psf	Total Load = DL + 0.75(VL + LL) =	32.4 psf
Total Deck Weight =	7942 lbs		

**Deck Sheets**

Deck Sheet Thickness =	0.1875 in	W = LL + DL(Deck Sheets) =	31.7 psf
Deck Sheet Fy =	50000 psi	Minimum Deck Thickness Required = (L <sup>2</sup> W / 300 Fy) <sup>0.5</sup>	
Maximum Rafter Spacing =	58 in	= 0.0843 in <	0.1875 in

**Rafters**

Distance Between Rafters At Shell =	4.833 ft	Rafter Load At Shell = q1 =	169 lb/ft
Distance Between Rafters At Center Ring =	0.327 ft	Rafter Load At Center Ring = q2 =	11 lb/ft
Horizontally Projected Length of Rafter = a =	11.475 ft	W =	905.2 lbs
		w =	11 lb/ft
Reaction At Shell = V1 = (a / 6) x (2q1 + q2) =	669 lbs		
Reaction At Center Ring = V2 = (a / 6) x (q1 + 2q2) =	367 lbs		
Maximum Moment Location = x = 0.5774 L =	6.73 ft		
Maximum Moment = M = ( 0.1283 W L ) + ( wx / 2 ( L - x ) ) =	1543 ft-lbs		
Rafter Type : C6 x 8.2		Plastic Section Modulus (Zx) :	5.16 in <sup>3</sup>
Rafter Length : 11.652 ft		Moment of Inertia (Ix) :	13.1 in <sup>4</sup>
Fy : 36000 psi		Modulus of Elasticity (E) :	29000 ksi
Ωb = 1.67			
Nominal Flexural Strength = Mn = Mp = Fy Zx =	185760 in-lbs =	15480 ft-lbs	
Mn / Ωb =	9269 ft-lbs >	1543 ft-lbs	
Maximum Deflection Location = x' = 0.5193 L =	6.05 ft		
Actual Deflection = ( 0.01304 ( W L <sup>3</sup> / E I ) + ( ( w x' / 24 E I ) x ( L <sup>3</sup> - 2 L x' <sup>2</sup> + x' <sup>3</sup> ) ) =	0.092 in		
Allowable Deflection = L / 120 =	1.165 in		

**Deck Support Beam**

Rafter Load at Center Ring = n V2 =	5880 lbs	Number of Support Beams =	2
Center Ring Cover Load = cr =	76 lbs	Beam Length = L =	24.560 ft
Equipment Load at Center Ring = eq =	1300 lbs	Unbraced Length = Lb =	6.140 ft
Load Per Beam = P = ((n V2 + cr) / 2) + eq =	4278 lbs		
Maximum Beam Reaction =	2555 lbs		
Maximum Bending Moment = M = ( P x L / 4 ) + ( bw L <sup>2</sup> / 8 ) =	28822 ft-lbs		
Beam Type : C15 x 33.9		Lp =	3.75 ft
Length : 24.560 ft		Lr =	14.5 ft
Fy : 50000 psi		Cb =	1.3
Modulus of Elasticity (E) : 29000 ksi		c =	1
Ωb = 1.67		Elastic Section Modulus (Sx) :	42 in <sup>3</sup>
		Plastic Section Modulus (Zx) :	50.8 in <sup>3</sup>
		Moment of Inertia (Ix) :	315 in <sup>4</sup>
Lp < Lb <= Lr		Nominal Flexural Strength = Mn =	3E+06 in-lbs = 249397 ft-lbs
		Mn / Ωb =	149339 ft-lbs > 28822 ft-lbs
		Actual Deflection = ( P L <sup>3</sup> / 48 E I ) + ( 5 bw L <sup>4</sup> / 384 E I ) =	0.280 in
		Allowable Deflection = L / 120 =	2.456 in

**BOLTED DECK DESIGN**

Continued

**Equipment Rafters**

Distance Between Rafters At Shell =	4.833 ft	Rafter Load At Shell = $q_1 =$	169 lb/ft
Distance Between Raftes At Center Ring =	0.327 ft	Rafter Load At Center Ring = $q_2 =$	11 lb/ft
Horizontally Projected Length of Rafter = $a =$	11.475 ft	Equipment Load = $P =$	1300 lbs
		$W =$	905.2 lbs
		$w =$	11 lb/ft

Reaction At Shell =  $V_1 = ((a / 6) \times (2q_1 + q_2)) + P / 2 =$  1319 lbs  
 Reaction At Center Ring =  $V_2 = ((a / 6) \times (q_1 + 2q_2)) + P / 2 =$  1017 lbs

Maximum Moment Location =  $x = 0.5774 L =$  6.73 ft  
 Maximum Moment =  $M = (0.1283 W L) + (w x / 2 (L - x)) + (P (L - x) / 2) =$  4744 ft-lbs

Rafter Type :	C6 x 8.2	Section Modulus ( $Z_x$ ) :	5.16 in <sup>3</sup>
Rafter Length :	11.652 ft	Moment of Inertia ( $I_x$ ) :	13.1 in <sup>4</sup>
$F_y$ :	36000 psi	Modulus of Elasticity ( $E$ ) :	29000 ksi
$\Omega_b =$	1.67		

Nominal Flexural Strength =  $M_n = M_p = F_y Z_x =$  185760 in-lbs = 15480 ft-lbs  
 $M_n / \Omega_b =$  9269 ft-lbs > 4744 ft-lbs

Maximum Deflection Location =  $x' = 0.5193 L =$  6.05 ft  
 Actual Deflection =  $(0.01304 (W L^3 / E I) + ((w x' / 24 E I) \times (L^3 - 2 L x'^2 + x'^3)) + ((P x / 48 E I) \times (3 L^2 - 4 x'^2)))$   
 Actual Deflection = 0.286 in  
 Allowable Deflection =  $L / 120 =$  1.165 in

**Rafter Ring**

Rafter Ring Radius = 10 in  
 Center Cover Load =  $c_r =$  76 lbs  
 Equipment Load at Center =  $e_q =$  1300 lbs  
 Rafter Load on Rafter Ring =  $n V_2 =$  5880 lbs  
 Total Load on Rafter Ring =  $Q =$  7256 lbs  
 Number of Support Points = 4

Maximum Bending Moment =  $M_x = 0.0342 Q R =$  2482 in-lbs  
 Maximum Torsional Moment =  $M_t = 0.0053 Q R =$  385 in-lbs

Rafter Ring Thickness :	0.25 in	Flange Width =	3.00
Rafter Ring Height :	4 in	Bottom Flange (Y/N) =	N in
$F_y$ :	40000 psi	Section Modulus ( $S_x$ ) :	2.44 in <sup>3</sup>
		Section Modulus ( $S_y$ ) :	0.70 in <sup>3</sup>

Combined Stress =  $M_x / S_x + 2 M_t / S_y =$  2115 psi < 16000 psi

Load per Rafter Ring Support Column = 1814 lbs

Column Type :	C4 x 5.4	Column Length ( $L$ ) =	2.02 ft
Area ( $A$ ) :	1.58 in <sup>2</sup>	$K =$	1.00
$r_x$ :	1.56	$KL / r_x =$	15.56
$r_y$ :	0.444	$KL / r_y =$	54.68
$F_y$ :	36000 psi		
Modulus of Elasticity ( $E$ ) :	30000 ksi		

$F_{ax} =$  20874 psi      Allow. Load per Support Column =  $F_a \times A =$  28461 lbs  
 $F_{ay} =$  18013 psi

**Venting Requirements**

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Ref NFPA 68, 2013 Chapter 8

D = Tank Diameter =	24.616 ft =	7.50 m
V = Tank Volume =	10261 ft <sup>3</sup> =	290.6 m <sup>3</sup>
L = Eff. Tank Length = Center of Relief Panel to Btm of Hopper =	21.40 ft =	6.52 m
Kst = Deflagration Index For Dust =	125 bar-m/sec	
Pstat = Vent Release Pressure =	32.00 oz/in <sup>2</sup> =	0.138 bar
Pred = Max. Pressure Developed During Venting =	46.39 oz/in <sup>2</sup> =	0.200 bar
Pmax = Max. Deflagration Pressure =	1779.4 oz/in <sup>2</sup> =	7.67 bar
A = Tank Cross Sectional Area =	475.91 ft <sup>2</sup> =	44.21 m <sup>2</sup>
L / D =	0.87	

$$Av0 = (1 \times 10^{-4}) (1 + 1.54 Pstat^{4/3}) Kst (V^{0.75}) ((Pmax/Pred)-1)^{0.5} \quad (8.2.2)$$

$$Av0 = 5.97 \text{ m}^2 = 64.23 \text{ ft}^2$$

L / D < 2

$$Av1 = Av0$$

$$Av1 = 5.97 \text{ m}^2 = 64.23 \text{ ft}^2$$

$$V = \text{Average Axial Velocity} = Q / A <= 19.9 \text{ m/sec} \quad (8.2.5.2)$$

$$Q = \text{Max. Flow Rate Thruouh The Tank} = 31312.9 \text{ ft}^3 / \text{sec} = 886.7 \text{ m}^3 / \text{sec}$$

$$Vtan = \text{Max. Tangential Velocity} <= 19.9 \text{ m/sec}$$

$$\text{For } V_{axial} \text{ or } V_{tan} < 20, Av2 = Avep = 7.55 \text{ m}^2 = 81.25 \text{ ft}^2$$

$$Mt = \text{Threshold Mass} = [6.67 Pred^{0.2} n^{0.3} (V / Kst^{0.5})]^{1.67} \quad (8.2.6.2)$$

$$n = \text{Number of Panels} = 4$$

$$Mt = 6415 \text{ kg/m}^2 = 1313.9 \text{ lb/ft}^2$$

$$M = \text{Mass Of Vent Panel} = 10 \text{ kg/m}^2 = 2.0 \text{ lb/ft}^2$$

$$\text{For } M <= Mt, Av3 = Av2 = 7.55 \text{ m}^2 = 81.25 \text{ ft}^2$$

$$Av = \text{Total Req'd Vent Area} = \text{Maximum of } Av0, Av1, Av2 \text{ or } Av3$$

$$Av = 7.55 \text{ m}^2 = 81.25 \text{ ft}^2$$

$$Fr = \text{Reaction Force During Venting} = 1.2 (Pred / 16) (144 Av) = 40712 \text{ lbs}$$

**Explosion Panel Analysis**

$$\text{Burst Pressure} = 1.50 \text{ psi} = 0.103 \text{ bar}$$

Fike, CV-S Rupture Panels

$$\text{Panel Width} = 44.0 \text{ in}$$

$$\text{Panel Height} = 69.0 \text{ in}$$

$$\text{Vent Area Per Panel} = 2925 \text{ in}^2 = 20.31 \text{ ft}^2 = 1.89 \text{ m}^2$$

$$\text{Using } 1 \text{ Panel(s) per Stave w/ } 4 \text{ Staves} = 4 \text{ Panels}$$

$$\text{Total Relief Area (Avep)} = 81.25 \text{ ft}^2 \Rightarrow 81.25 \text{ ft}^2$$

$$\text{Total Relief Area (Avep)} = 7.55 \text{ m}^2 \Rightarrow 7.55 \text{ m}^2$$

Pressure Check For Deck

pg 25 of 30

Tank Diameter (D) = 24.616 ft = 295 in  
 Deck Slope From Horz. (Theta) = 10 deg  
 Internal Tank Design Pressure (P) = 0.28 psi = 4.50 oz/in<sup>2</sup>  
 Max. Pressure Developed During Venting (Pred) = 2.90 psi = 46.39 oz/in<sup>2</sup>

Deck

Deck Construction Mat. ( C / A / S ) : C

Fy = 50000 psi

Deck Thickness (Th) = 0.1875 in

Deck Mat. Density (q) = 0.2833 pci

Radius Normal To Deck (Rh) = 850.6 in

Shell

Top Ring Construction Mat. ( C / A / S ) : C

Fy = 50000 psi

Top Ring Thickness (Tc) = 0.1875 in

Compression Bar

Compression Bar ( Y or N ) : Y

Bar Construction Mat. ( C / A / S ) : C

Fy = 50000 psi

Compression Bar Thickness (Rt) = 0.25 in

Compression Bar Height (Rh) = 8 in

Hardware

Chime Bolt Size : 0.500 in  
 Deck Seam Bolt Size : 0.500 in

Mat. Grade : Gr5  
 Mat. Grade : Gr5

Fu

120 ksi  
 120 ksi

Full Shank (Y/N) : N  
 Full Shank (Y/N) : N

Deck To Sidewall Junction Analysis

Wh = 0.3 (Rh Th)<sup>0.5</sup> = 3.789 in  
 Wc = 3.25 + (Rh - 2) + (16 Tc) = 12.250 in  
 Ah = (2 + Wh) x Th = 1.085 in<sup>2</sup>  
 Ac = (2 + Wc) x Tc = 2.672 in<sup>2</sup>  
 Ar = Rt + Rh = 2.000 in<sup>2</sup>

Total Area (At) = 5.75723 in<sup>2</sup>  
 Average Yield (Avg Fy) = 50000 psi

Compression RingAllowable Pressure (Pa) - Decks w/ Seperate Rafters (>21' dia.)

Pa = { [( 0.056 x Avg Fy x At x Tan Theta) / D<sup>2</sup> ] + Density of Deck x Th } / 2 = 2.37 psi  
 37.95 oz/in<sup>2</sup>

Allowable Pressure = 37.95 oz/in<sup>2</sup> > 4.50 oz/in<sup>2</sup> OK!

Failure Pressure (Pf)

Pf = [ ( 0.056 x Avg Fy x At x Tan Theta) / D<sup>2</sup> ] + Density of Deck x Th = 4.74 psi  
 75.90 oz/in<sup>2</sup>

2/3 of Failure Pressure = 50.60 oz/in<sup>2</sup> > 46.39 oz/in<sup>2</sup> OK!

**Pressure Check For Deck  
continued**

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**Eave Bolted Connection**

Deck Sheet Controlling Allowable Bolt Load = 4257 lb / bolt (Bolt Shear)  
 Deck Sheet Controlling Critical Bolt Load = 10217 lb / bolt (Bolt Shear)

Top Ring Controlling Allowable Bolt Load = 4257 lb / bolt (Bolt Shear)  
 Top Ring Controlling Critical Bolt Load = 10217 lb / bolt (Bolt Shear)

Quantity of Bolts = 464.001  
 Area of Deck = 68531 Sq. In.

**Allowable Pressure (Pa)**

$Pa = \tan \theta * \text{Allowable Bolt Load} * \text{Qty of Bolts} / \text{Area of Deck} =$  5.08 psi  
 81.31 oz/in<sup>2</sup>

Allowable Pressure = 81.31 oz/in<sup>2</sup> > 4.50 oz/in<sup>2</sup> OK!

**Failure Pressure (Pf)**

$Pf = \tan \theta * \text{Critical Bolt Load} * \text{Qty of Bolts} / \text{Area of Deck} =$  12.20 psi  
 195.16 oz/in<sup>2</sup>

2/3 of Failure Pressure = 130.10 oz/in<sup>2</sup> > 46.39 oz/in<sup>2</sup> OK!

**Radial Seam Bolted Connection**

Deck Sheet Controlling Allowable Bolt Load = 4257 lb / bolt (Bolt Shear)  
 Deck Sheet Controlling Critical Bolt Load = 10217 lb / bolt (Bolt Shear)

Max. Allowable Radial Tension (Ta) = Allow. Bolt Load / 2 in = 2128 lb / in  
 Max. Critical Radial Tension (Tc) = Critical Bolt Load / 2 in = 5108 lb / in  
 Radius Normal To Deck (Rh) = 850.6 in

**Allowable Pressure (Pa)**

$Pa = (Ta / Rh) * \cos \theta =$  2.46 psi  
 39.43 oz/in<sup>2</sup>

Allowable Pressure = 39.43 oz/in<sup>2</sup> > 4.50 oz/in<sup>2</sup> OK!

**Failure Pressure (Pf)**

$Pa = (Tc / Rh) * \cos \theta =$  5.91 psi  
 94.63 oz/in<sup>2</sup>

2/3 of Failure Pressure = 63.09 oz/in<sup>2</sup> > 46.39 oz/in<sup>2</sup> OK!

**Vacuum Check For Shells**Pg 27 of 30

Ref. Structural Analysis Of Shell, Baker, pg 236

$$\text{Stress} = K_p \{ \pi^2 E / (12(1-u^2)) \} (t/L)^2$$

$$P_{cr} = \text{Critical Vacuum} = \text{Stress } t / R$$

$$Z = \{ L^2 / (R t) \} (1-u^2)^{0.5}$$

$$K_p (\text{For Lateral \& Axial Pressure}) = 1.04 (Z^{0.5})$$

$$p' = \text{Allowable Vacuum} = 16 \{ [K_p \{ \pi^2 E / (12(1-u^2)) \} (t/L)^2] t / R \} / 2$$

Tank Diameter = 24.616 ft  
 Design Vacuum (v) = 0.5 oz/in<sup>2</sup>  
 Tank Radius (R) = 147.7 in  
 Modulus of Elasticity (E) = 29000000 psi  
 Poisson's Ratio (u) = 0.33

Nominal Gage	Average Ring Thickness (in)	Ring Ht. (in)	Total Ring Ht. L (in)	Average Thickness t (in)	Z	Kp	Allowble Vacuum p' (oz/in <sup>2</sup> )		Vacuum v (oz/in <sup>2</sup> )
3/16 pl	0.203	96.72	96.72	0.2030	295	17.8	23.14	>	0.50
3/16 pl	0.203	43.68	140.40	0.2030	621	25.9	15.94	>	0.50
5/16 pl	0.338	34.24	174.64	0.2295	849	30.3	17.41	>	0.50

Cast-In Headed Anchor Boltspg 28 of 30

Per IBC 2012 / ACI 318-11 Appendix D  
For Seismic Design Category A and B only

$$\begin{aligned}
 W &= \text{Equivalent Vertical Wind Load} = 85046 \text{ lbs} \\
 &\quad \text{Wind Base Shear} = 19126 \text{ lbs} \\
 \rho &= \text{redundancy factor} = 1 \\
 &\quad S_{ds} = 0.135 \\
 E &= \text{Combined Earthquake Load} = 263722 \text{ lbs} \\
 &\quad \text{Seismic Base Shear} = 43938 \text{ lbs} \\
 DL &= \text{Tank Dead Load} = 79509 \text{ lbs} \\
 EQ &= \text{Equipment Load} = 4800 \text{ lbs} \\
 PW &= \text{Product Weight} = 694126 \text{ lbs} \\
 De &= \text{Dead Load Empty} = DL = 79509 \text{ lbs} \\
 Do &= \text{Dead Load Operating} = DL + EQ + PW = 778435 \text{ lbs} \\
 \mu &= \text{Coefficient of Friction (Base of Tank to Foundation)} = \tan 30^\circ = 0.577 \\
 n &= \text{Anchor Bolt Qty.} = 32 \\
 N_u(w) &= \text{Wind Uplift} = (W - 0.9De) / n = 422 \text{ lbs/bolt} \\
 N_u(s) &= \text{Seismic Uplift} = (\rho E - 0.9Do) / n = 0 \text{ lbs/bolt} \\
 V_u(w) &= ((\text{Wind Base Shear}) - ((\mu \times De) \times 0.9)) / (n / 2) = 0 \text{ lbs/bolt} \\
 V_u(s) &= ((\rho \text{ Seismic Base Shear}) - (\mu \times 0.9Do \times (1 - 0.2 \times S_{ds}))) / (n / 2) = 0 \text{ lbs/bolt}
 \end{aligned}$$

**STEEL:**

$$\begin{aligned}
 d_o &= \text{Anchor Bolt Diameter (Max. 2 in)} = 0.75 \text{ in} \\
 n_t &= \text{Number of Threads per Inch} = 10 \\
 &\quad \text{A36 All Thread Anchor Bolts}
 \end{aligned}$$

$$\begin{aligned}
 f_{ut} &= \text{Minimum Tensile Strength} = 58000 \text{ psi} \\
 A_{se} &= \text{Effective Cross-Sectional Area} = 0.334 \text{ sqin} \\
 A_{brg} &= \text{Anchor Bolt Head Area} = 0.911 \text{ in}^2 \\
 \phi(t) &= \text{Strength Reduction Factor for Tension} = 0.75 \\
 \phi(v) &= \text{Strength Reduction Factor for Shear} = 0.65
 \end{aligned}$$

$$\begin{aligned}
 N_s &= \text{Nominal Strength of Fastener in Tension} = A_{se} f_{ut} = 19399 \text{ lbs} \\
 V_s &= \text{Nominal Strength of Fastener in Shear} = 0.6 A_{se} f_{ut} = 11639 \text{ lbs}
 \end{aligned}$$

$$\begin{aligned}
 \text{Anchor bolts with maximum tension} \quad (N_u(w) / \phi(t) N_s) &= 0.03 \leq 1.00 \\
 (N_u(s) / \phi(t) N_s) &= 0.00 \leq 1.00
 \end{aligned}$$

$$\begin{aligned}
 \text{Anchor bolts with combined tension \& shear} \quad (0.5 N_u(w) / \phi(t) N_s) + (0.5 V_u(w) / \phi(v) V_s) &= 0.01 \leq 1.20 \\
 (0.5 N_u(s) / \phi(t) N_s) + (0.5 V_u(s) / \phi(v) V_s) &= 0.00 \leq 1.20
 \end{aligned}$$

$$\begin{aligned}
 \text{Anchor bolts with maximum shear} \quad (V_u(w) / \phi(v) V_s) &= 0.00 \leq 1.00 \\
 (V_u(s) / \phi(v) V_s) &= 0.00 \leq 1.00
 \end{aligned}$$

Use 32 3/4" Diameter A36 All Thread Anchor Bolts



**Cast-In Headed Anchor Bolts**  
**Per IBC 2012 / ACI 318-05 Appendix D**  
**For Seismic Design Category A and B only**

**CONCRETE:**

Anchor Bolt Circle =	301.642 in	Anchor Bolt Spacing = $S_1$ =	29.424 in
Inside Edge Distance = $C_{a1}$ =	9.000 in	Min. Anchor Bolt Edge Distance = $6d_o$ =	4.500 in
Outside Edge Distance = $C_{a3}$ =	9.000 in	Min. Anchor Bolt Spacing = $4d_o$ =	3.000 in
Anchor Bolt Embedment (Max. 25 in) = $h_{ef}$ =	12.500 in	Supp. Tension Reinf. Provided? (Y/N) :	N
Min. Concrete Thickness = $h_{ef} + 3 = h_s$ =	15.500 in	Supp. Shear Reinf. Provided? (Y/N) :	N
Concrete $f'_c$ (Max. 10,000 psi) =	4000 psi	Cracked Concrete? (Y/N) :	Y

**Concrete Breakout (Tension)**

$A_{Nco} = 1406.3 \text{ in}^2$	$A_{Nc} = 17057.5 \text{ in}^2$	$N_b = 67082 \text{ lbs}$
$h'_{ef} = N/A$	$\Psi_{ec,N} = 1.00$	$N_{cbg} = 686753 \text{ lbs}$
$1.5h'_{ef} = 18.75 \text{ in}$	$\Psi_{ed,N} = 0.84$	$\phi = 0.70$
$c_{a,max} = 9.00 \text{ in}$	$\Psi_{c,N} = 1.00$	$\phi N_{cbg} = 480727 \text{ lbs}$
$c_{a,min} = 9.00 \text{ in}$	$\Psi_{cp,N} = N/A$	$\phi N_{cb} = 15023 \text{ lbs}$
$S_{max} = 29.4 \text{ in}$		

**Concrete Pullout (Tension)**

$N_p = 29152 \text{ lbs}$	$N_{pn} = 29152 \text{ lbs}$	$\phi N_{pn} = 20406 \text{ lbs}$
$\Psi_{c,p} = 1.00$	$\phi = 0.70$	

**Side Face Blowout (Tension)**

$N_{sb} = N/A$	$\phi = 0.70$	$\phi N_{sb} = N/A$
----------------	---------------	---------------------

**Concrete Breakout (Shear)**

$c_{a1} = 9.00 \text{ in}$	$V_b = 18172 \text{ lbs}$	$\Psi_{h,v} = 1.00$
$1.5c_{a1} = 13.50 \text{ in}$	$\Psi_{ec,v} = 1.00$	$V_{cb} = 16354 \text{ lbs}$
$A_{vco} = 364.5 \text{ in}^2$	$\Psi_{ed,v} = 0.90$	$\phi = 0.70$
$A_{vc} = 364.5 \text{ in}^2$	$\Psi_{c,v} = 1.00$	$\phi V_{cb} = 11448 \text{ lbs}$

**Concrete Pryout (Shear)**

$k_{cp} = 2$	$V_{cpg} = 1373505 \text{ lbs}$	$\phi V_{cpg} = 961454 \text{ lbs}$
$N_{cbg} = 686753 \text{ lbs}$	$\phi = 0.70$	$\phi V_{cp} = 30045 \text{ lbs}$

Anchor bolts with maximum tension	$(N_u (w) / \phi N_{cb}) =$	0.03 $\leq$ 1.00
	$(N_u (s) / \phi N_{cb}) =$	0.00 $\leq$ 1.00

Anchor bolts with combined tension & shear	$(0.5 N_u (w) / \phi N_{cb}) + (0.5 V_u (w) / \phi V_{cb}) =$	0.01 $\leq$ 1.20
	$(0.5 N_u (s) / \phi N_{cb}) + (0.5 V_u (s) / \phi V_{cb}) =$	0.00 $\leq$ 1.20

Anchor bolts with maximum shear	$(V_u (w) / \phi V_{cb}) =$	0.00 $\leq$ 1.00
	$(V_u (s) / \phi V_{cb}) =$	0.00 $\leq$ 1.00

Ductility Check:

Ductility Check Not Required For Category A and B

Loadings at Tank Base

Customer : Komline Sanderson Engineering      Sales Order : 15-4663-65  
 Engineer : DRS      10/08/15      Revision : B - DRS 3/23/16  
 Checker :

Tank Diameter : 24.616 ft  
 Tank Height : 52.000 ft  
 Hopper Angle : 60 Deg.  
 Hopper Opening : 12.000 Ft.  
 Hopper Clearance : 26.521 ft  
 Angle of Repose : 0 deg  
 Tank Design Volume : 9916 ft<sup>3</sup>  
 Product : Dried Sludge  
 Bulk Density : 70 pcf  
 Wind Design : IBC 2012 / ASCE 7-10  
     Velocity = 120 mph  
     Exposure : C

Seismic Design : IBC 2012 / ASCE 7-10  
     Ss = 12.70 %      Sds = 0.135  
     S1 = 5.80 %      Sd1 = 0.093  
     Site Class = D      Ie = 1.25  
     Seismic Design Category = B      R = 3.0  
     V = 0.056 W

Deck Snow Load : IBC 2012 / ASCE 7-10  
     Ground Snow Load = pg = 25 psf  
     Is = 1.1  
     Deck Snow Load = pf = 24 psf

Deck Live Load : 20 psf  
 Mat'l Of Construction : Carbon Steel

Product Load = 694.126 kips  
 Tank Dead Load = 79.509 kips  
 Equipment Load = 4.800 kips  
 Deck Live Load = 9.518 kips  
 Deck Snow Load = 11.422 kips  
 Equip or Platform Live Load = 47.591 kips  
 Base Shear Wind = 19.126 kips  
 Overturning Moment Wind = 523.375 kips-ft  
 Base Shear Seismic = 43.938 kips  
 Overturning Moment Seismic = 1752.737 kips-ft

All loads are unfactored loads

**Komline-Sanderson**12 Holland Av  
908-234-1000Peapack, NJ 07977-0257  
Fax: 908-234-9487  
[www.komline.com](http://www.komline.com)

## OPERATION AND MAINTENANCE MANUAL

Title of Project: Lake County Public Works Department  
Des Plaines River WRF  
Phases 2B & 3 Improvements

Specification Number: 11650H Paragraph 2.4 E  
Specification Title: Detail Biosolids Thermal Drying System  
Vibrating Bin Dischargers  
Tags: M-12-7, M-12-10 & M-12-13

Manufacturer: Metalfab, Inc.

General Contractor: Williams Brothers Construction, Inc.

Subcontractor:

Supplier: Komline-Sanderson

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O&M MANUAL SUBMITTAL CHECKLIST (Page 1 of 5)

PROJECT NAME Des Plaines River WRF

CONTRACT NO. K-S Job D0493

CONTRACTOR Komline-Sanderson

EQUIPMENT/SYSTEM Vibrating Bin Dischargers

SECTION NO. 11650H

MANUFACTURER/VENDOR Metalfab

FORMAT

Size: 8-1/2 x 11 or 11 x 17  
 Paper: 20-pound minimum  
 Text: Printed data/neatly typed  
 Drawings: Standard size bound in text; in text-size labeled envelopes

Tabbed Section Dividers

Cover Label: Title  
 Project Name  
 Building/Structure ID  
 Equipment Name  
 Specification Section

Binders: Plastic Cover



O&M MANUAL SUBMITTAL CHECKLIST (Page 2 of 5)

GENERAL CONTENTS

<u>Provided</u>	<u>Not Applicable</u>	<u>Page No.</u>	
	X		One Specification Only
<u>X</u>		<u>1</u>	Title Page:
<u>X</u>		<u>1</u>	Title
<u>X</u>		<u>1</u>	Project title
	X		Building/structure ID
<u>X</u>		<u>1</u>	Equipment name
<u>X</u>		<u>1</u>	Specification section number
<u>X</u>		<u>1</u>	Contractor ID
	X		Subcontractor ID
<u>X</u>		<u>9</u>	Purchase order data
<u>X</u>		<u>1, 9</u>	Manufacturer ID
<u>X</u>		<u>1, 9</u>	Service/parts supplier ID
<u>X</u>		<u>Varies</u>	Product List
<u>X</u>		<u>2</u>	Table of Contents
	X		Tabbed Sections:
	X		Pertinent data sheets
<u>X</u>		<u>Varies</u>	Annotated as needed
<u>X</u>		<u>Varies</u>	Text:
<u>X</u>		<u>Varies</u>	Pertinent to project
<u>X</u>		<u>Varies</u>	Annotated
<u>X</u>		<u>42</u>	Drawings:
<u>X</u>		<u>40</u>	Illustrate product and components
	X		Control and flow diagrams
<u>X</u>		<u>Varies</u>	Special Information:
<u>X</u>		<u>Varies</u>	Interrelationships of equipment and components
<u>X</u>		<u>Varies</u>	Instructions and procedures
<u>X</u>		<u>Varies</u>	Instructions organized in
<u>X</u>		<u>Varies</u>	Instructions in logical
	X		Glossary
	X		Warranty, Bond, Service Contract

O&M MANUAL SUBMITTAL CHECKLIST (Page 3 of 5)

MANUAL FOR MATERIALS AND FINISHES

<u>Provided</u>	<u>Not Applicable</u>	<u>Page No.</u>	
_____	<u>X</u>	_____	Building Products:
_____	<u>X</u>	_____	Product data
_____	<u>X</u>	_____	Catalog number
_____	<u>X</u>	_____	Size
_____	<u>X</u>	_____	Composition
_____	<u>X</u>	_____	Color and texture designations
_____	<u>X</u>	_____	Care and Maintenance Instructions
_____	<u>X</u>	_____	Recommended cleaning agents and methods
_____	<u>X</u>	_____	Cleaning precautions
_____	<u>X</u>	_____	Cleaning and maintenance schedule
_____	<u>X</u>	_____	Moisture Protection Products:
_____	<u>X</u>	_____	Product data listing
_____	<u>X</u>	_____	Chemical composition
_____	<u>X</u>	_____	Installation details
_____	<u>X</u>	_____	Inspection recommendations
_____	<u>X</u>	_____	Maintenance and repair
_____	<u>X</u>	_____	Additional Data as Required

O&M MANUAL SUBMITTAL CHECKLIST (Page 4 of 5)

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<u>      </u>	<u>X</u>	<u>      </u>	Normal operating characteristics
<u>      </u>	<u>X</u>	<u>      </u>	Limiting conditions
<u>      </u>	<u>X</u>	<u>      </u>	Performance curves
<u>X</u>	<u>      </u>	<u>42</u>	Engineering data
<u>      </u>	<u>X</u>	<u>      </u>	Test data
<u>X</u>	<u>      </u>	<u>40, 41</u>	Replaceable parts list (with numbers)
<u>X</u>	<u>      </u>	<u>1</u>	P&ID numbers
<u>X</u>	<u>      </u>	<u>Varies</u>	Operating Procedures:
<u>X</u>	<u>      </u>	<u>15, 31</u>	Startup
<u>      </u>	<u>X</u>	<u>      </u>	Break-in
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<u>      </u>	<u>X</u>	<u>      </u>	Emergency
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<u>X</u>	<u>      </u>	<u>Varies</u>	Routine/normal instructions
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<u>      </u>	<u>X</u>	<u>      </u>	Disassembly/reassembly/repair
<u>X</u>	<u>      </u>	<u>15, 16, 30</u>	Alignment/adjusting/balancing
<u>X</u>	<u>      </u>	<u>      </u>	Servicing and Lubrication:
<u>X</u>	<u>      </u>	<u>11</u>	List of lubricants
<u>X</u>	<u>      </u>	<u>10, 33</u>	Lubrication schedule
<u>X</u>	<u>      </u>	<u>10</u>	Maintenance schedule
<u>X</u>	<u>      </u>	<u>15, 20, 22</u>	Safety Precautions/Features
<u>      </u>	<u>X</u>	<u>      </u>	Sequence of Operation of Controls
<u>X</u>	<u>      </u>	<u>42</u>	Assembly Drawings
<u>X</u>	<u>      </u>	<u>40</u>	Parts List and Illustrations:
<u>      </u>	<u>X</u>	<u>      </u>	Predicted life
<u>      </u>	<u>X</u>	<u>      </u>	Recommended spare parts list and prices
<u>      </u>	<u>X</u>	<u>      </u>	Control Diagrams/Schematics
<u>X</u>	<u>      </u>	<u>40</u>	Bill of Materials

O&M MANUAL SUBMITTAL CHECKLIST      (Page 5 of 5)

<u>Provided</u>	<u>Not Applicable</u>	<u>Page No.</u>	
<u>X</u>	<u>          </u>	<u>9</u>	Completed Equipment Data Form per Specification
<u>          </u>	<u>X</u>	<u>          </u>	Valves
<u>X</u>	<u>          </u>	<u>Varies</u>	Catalog Cuts and Tag Numbers
<u>X</u>	<u>          </u>	<u>Varies</u>	Maintenance Instructions
<u>          </u>	<u>X</u>	<u>          </u>	Panelboard Directories:
<u>X</u>	<u>          </u>	<u>Varies</u>	Electrical
<u>          </u>	<u>X</u>	<u>          </u>	Controls
<u>          </u>	<u>X</u>	<u>          </u>	Communications
<u>          </u>	<u>X</u>	<u>          </u>	Instrumentation Loops:
<u>          </u>	<u>X</u>	<u>          </u>	Diagrams
<u>          </u>	<u>X</u>	<u>          </u>	Components list each circuit/loop
<u>          </u>	<u>X</u>	<u>          </u>	Additional Data As Required

## EQUIPMENT DATA FORM (Page 1 of 3)

PROJECT NAME Des Plains River WRF

CONTRACT NO. K-S Job D0493

CONTRACTOR Komline-Sanderson

EQUIPMENT NO. M-12-7, M-12-10, M-12-13

DESCRIPTION Vibrating Bin Dischargers

LOCATION 800 Krause Drive, Buffalo Grove, IL 60089

MANUFACTURER Metalfab, Inc.

PURCHASED FROM Metalfab, Inc. PURCHASE DATE 11/6/2015

VENDOR ORDER NO. 1115014 PURCHASE PRICE \$100,578

LOCAL SUPPLIER Metalfab, Inc. PHONE \_\_\_\_\_

ADDRESS Prices Switch Road, Vernon, NJ 07462

MODEL NO. BA-12-JAPH-S14MM SHIPPING WT/UNIT 7,100 lbs

NO. OF UNITS 3 SERIAL NOS. 1115014

## NAMEPLATE DATA

<u>ELECTRIC MOTOR</u>	<u>PUMP/HVAC UNIT</u>	<u>DRIVE/REDUCER</u>	<u>OTHER (I&amp;C)</u>
MANUFACTURER:	MANUFACTURER:	MANUFACTURER:	MANUFACTURER:
<u>Italvibras USA</u>	_____	_____	_____
TYPE: <input checked="" type="checkbox"/> AC <input type="checkbox"/> DC	TYPE _____	TYPE: <input type="checkbox"/> GEAR <input type="checkbox"/> V-BELT <input type="checkbox"/> CHAIN <input type="checkbox"/> VARIDRIVE	TYPE _____
HP <u>7</u>	SIZE _____		SIZE _____
RPM <u>1,800</u>	CAPACITY _____		CAPACITY _____
VOLTAGE <u>460</u>	PRESSURE _____	SERVICE FACTOR _____	RANGE _____
AMPERAGE <u>9</u>	ROTATION _____	RATIO _____	
PHASE <u>3</u>	IMPELLER: SIZE _____		
FRAME <u>90</u>	MATERIAL _____		

EQUIPMENT DATA FORM (Page 2 of 3)

MAINTENANCE SUMMARY

EQUIPMENT NO. M-12-7, M-12-10, M-12-13

DESCRIPTION Vibrating Bin Dischargers

MAINTENANCE OPERATION

List briefly each maintenance operation required and refer to specific information in Manufacturer's Maintenance Manual, if applicable. Refer by symbol to "Lubricant List" for Lubrication Operation.

FREQUENCY

List required frequency of each maintenance operation.

<u>Tighten all nuts and bolts</u>	<u>Every 3 months minimum</u>
<u>Lubricate vibrator</u>	<u>Every 2,000 hours</u>
<u>Check sleeve clamp tightness. Check for sleeve damage</u>	<u>Periodically</u>
<u>Inspect the cord for any visible damage or wear</u>	<u>Every 3 months</u>
<u>Remove the wiring box cover and inspect for any foreign matter or liquid</u>	<u>Every 3 months</u>
<u>Inspect the wiring box cover O-ring and rubber compression block.</u>	<u>Every 3 months</u>
<u>Remove each weight cover and inspect for foreign matter. Replace O-rings if they are damaged</u>	<u>Every 3 months</u>
<u>Check the mounting bolt torque</u>	<u>Every 3 months</u>
<u>Replace any broken parts</u>	<u>Every 3 months</u>
<u> </u>	<u> </u>
<u> </u>	<u> </u>
<u> </u>	<u> </u>
<u> </u>	<u> </u>
<u> </u>	<u> </u>

## EQUIPMENT DATA FORM (Page 3 of 3)

(Page 3 of 3)

## LUBRICANT/RECOMMENDED SPARE PARTS LIST

EQUIPMENT NO. M-12-7, M-12-10, M-12-13DESCRIPTION Vibrating Bin Dischargers

## LUBRICANT LIST

LUBRICANT REFERENCE SYMBOL	LUBRICANT TYPE (MILITARY STANDARD)	RECOMMENDED AND MANUFACTURER
List symbol in "maintenance operation"	List general lubricant type	List specific lubricant name, viscosity and manufacturer
		Kluber NBU8EP Grease

## RECOMMENDED SPARE PARTS LIST

<u>PART NO.</u>	<u>DESCRIPTION</u>	<u>UNIT</u>	<u>QUANTITY</u>	<u>UNIT COST</u>
None listed. Order replacement parts as required. Refer to Italvibras manual for vibrator parts list diagram				

NOTE: Identify parts provided by this Contract with two asterisks.

### ADDITIONAL DATA AND REMARKS

---



# INSTALLATION AND OPERATING INSTRUCTIONS

## METALFAB BIN ACTIVATORS

### Description

1. Upper hanger (suspension arm) brackets are pre-assembled, at the factory, to a flanged cylindrical section. It insures proper alignment of the suspension arms and sleeve clamping surfaces.
2. Flanged mounting ring may be provided with bolt holes for bolting to a mating flange on the bin.

**Note:**        **Nuts, bolts and gasketing for the mating flanges are not supplied by Metalfab. Use high strength, grade 5 bolts and locknuts.**

3. When being installed on a conical section of a bin, it can also be welded directly to the bin cone. The cone may be butted against the horizontal or inside diameter of the flange and seal welded.
4. Before doing any welding, remove the vibrator from the Bin Activator.
5. In all cases, regardless of installation procedures, the mounting flange must not be distorted or bent during installation.
6. Even though the locating of suspension brackets is done with special equipment, it is recommended that mating parts be maintained, i.e., do not interchange mounting flanges from one serial numbered unit with another serial numbered unit.
7. To insure proper fit and alignment, plan view orientation of the hopper mounting flange with relation to the Bin Activator must not be changed.
8. In most cases, generally 3 foot through 8 foot diameter units, the mounting flange is shipped pre-assembled to the Bin Activator. For 10 foot diameter and larger, the mounting flange is split in half and shipped on the same skid as the Bin Activator or separately. A metal brace may be welded to each half section to prevent distortion during shipment. If so, remove after installation.

## Installation \_ Assembly

1. Specific sequence of installing a **Metalfab Bin Activator** can be changed to suit individual requirements. Most important is the end result, i.e., proper alignment and tightness of nuts, bolts and sleeve clamps.
2. Plan view orientation of the vibrator location with respect to the storage bin is not critical. It can be located to suit.
3. For units provided with bolt holes, the bolt holes can be pre-drilled in the mating bin flange. Care must be taken to make certain that the flange is not warped or not distorted. If the bin flange is warped, distorted or not level, transfer bolt holes from the mounting flange at the time of installation. Shim, with metal, as required before bolting mating flanges.
4. The mating flanges can also be welded, continuous internal and intermittent or continuous external.
5. When bolting the mating flange, it is good practice to use a sealant such as Permatex, Silastic or similar material between the flanges to prevent leakage of fine particle size products. A thin, approximately 1/8" gasket of resilient material may be used in place of a sealant. Sealant by others.
6. After installing the completely assembled Bin Activator and tightening all bolts, run the unit empty for approximately ten minutes. Then recheck the suspension arm bolts, vibrating mounting bolts and sleeve clamps for tightness. Suspension arm bolts are Grade 5 and must be torqued to 466 foot pounds; vibrator mounting bolts as follows:

3 / 8" BOLT.....GRADE 5 .....	35 FOOT POUNDS
1 / 2" BOLT.....GRADE 5 .....	125 FOOT POUNDS
5 / 8" BOLT.....GRADE 5 .....	160 FOOT POUNDS
3 / 4" BOLT.....GRADE 8 .....	310 FOOT POUNDS
7 / 8" BOLT.....GRADE 8 .....	473 FOOT POUNDS
1" BOLT.....GRADE 8 .....	540 FOOT POUNDS

7. **Metalfab** 10 foot and 12 foot diameter Bin Activators and special units are shipped unassembled, in some cases the mounting flange is split in half for shipping purposes.

8. When installing units not completely assembled, the correct procedure is to completely assemble the unit at grade with the following procedure:
  - A. Stand or support the Bin Activator in a level position (discharge outlet facing down).
  - B. If applicable, join the two (2) halves of the upper mounting flange and tighten securely or weld.
  - C. If not already in position, place the flexible sleeve and two (2) complete sleeve clamps on the Bin Activator\*\*\*\*\*leave clamps loose.
  - D. Position the assembled mounting flange on the Bin Activator.
  - E. Install all suspension arms, insert high strength bolts in upper and lower holes and snug up each elastic stop nut and bolt. After all nut bolts are installed snug, tighten to the correct torque specifications.
  - F. Check placement of the flexible sleeve to mounting flange and Bin Activator. A sealant material such as Silastic or Permatex may be used between the sleeve and metal surfaces.
  - G. Position the upper and lower sleeve clamps close to the beaded edge of the flexible sleeve. After seating and adjusting clamps, tighten both securely.

**Note:**      **When tightening the clamps, be sure to support the far side tube with vise grip pliers when turning nut. Failure to do so, may cause a twisting action on strapping which may lead to damage of clamp.**

9. Run the unit as noted previously and tighten bolts as required, including sleeve clamps.

## **Vibrator Installation**

1. This unit imparts vibration to the Bin Activator. It must be securely bolted to the unit (torque mounting bolts according to previous instructions), and all bolts must be retightened after the first ten minutes of operation and again during the second day of operation. All nuts and bolts, especially vibrator mounting bolts, should be retightened every three (3) months or more frequently depending on the amount of usage.

2. Because the Bin Activator and the motor vibrate, the electrical connections must be made with flexible lead. Braided neoprene covered cable is recommended.
3. Refer to wiring diagram in motor conduit box for wiring instructions.

## **Vibrator Force Adjustment**

**Warning: Vibrator must be electrically locked-out before any adjustment or maintenance can be performed.**

1. The centrifugal force setting of the vibrator is set at the factory for the minimum force level that will produce flow of product. If flow is not instantaneous or continuous, it may be necessary to increase the centrifugal force. To do so, the following procedure should be followed:
  - 1) Remove the bolts of both the upper and lower end covers.
  - 2) Remove end covers exposing the four (4) eccentric weights.
- Note: The (2) OUTER weights on the *INVICTA* Explosion Proof and the *METALFAB* TENV Vibrators are the weights to be adjusted. The (2) INNER weights on the *INVICTA* TENV Vibrators are the weights to be adjusted.**
2. To increase the force setting, loosen the clamping bolt on the two (2) weights that will be adjusted. (See note above).
3. Refer to the applicable vibrator operation and maintenance instructions for force settings and technical information.
4. As the centerline of the adjusted weights approach the centerline of the fixed weights, the centrifugal force is increased. When the weights centerline is opposed, the centrifugal force decreases. If the centerlines of all four (4) weights are completely aligned, you will develop the maximum force available for that size vibrator.
5. Regardless of which vibrator you have, when you have completed your force adjustment, the OUTER weights should be in line with each other and the INNER weights should be in line with each other. ANY OTHER ARRANGEMENT WILL RESULT IN A MOTION THAT CAN DAMAGE THE VIBRATOR AND BE VERY DETRIMENTAL TO THE APPLICATION, WELDS OF THE BIN ACTIVATOR AND SUPPORT STRUCTURES.
6. Assemble the unit by reversing the procedure outline as above.

**Note:** Bin Activator vibrator should be electrically interlocked with down stream feed devices, i.e., when screw, belt, rotary, etc. feeder stops \_ vibrator should also stop.

## Full Load and Starting Current

See Vibrator Instruction Manual and Motor Nameplate Data.

## Secondary Baffle

1. The secondary baffle has been positioned by **Metalfab** engineering for your application requirements. Its position will allow for the proper flow of product through the Bin Activator outlet.
2. The position of the secondary baffle is maintained by an Esna type lock nut. The secondary baffle can be repositioned vertically by using a deep socket type wrench to loosen the lock nut, thereby, allowing the secondary baffle to be turned, possibly by hand, on the threaded section of the extended rod, to a higher or lower position. Since the secondary baffle is located near the outlet, it is easily accessible from the outlet.
3. If flow problems occur, the secondary baffle could be repositioned to help eliminate the problem. Before making any adjustments, it is advisable to check with **Metalfab** engineering for advice as to what new position might be helpful.

## Maintenance Instructions

### 1. **Vibrator Lubrication**

The vibrators are lubricated as supplied. The lubrication is good for 2,000 to 5,000 hours. See vibrator instructions.

### 2. **Flexible Sleeve**

Aside from checking the clamp tightness, there is no maintenance required on the sleeve. Periodic visual checks should be made to see if there is damage caused by chemical attack or mechanical damage to the elastomer.

**Note:** Standard sleeve is Neoprene with a maximum temperature rating of 210°F. Optional sleeves are NORDEL with a maximum temperature rating of 325°F and VITON with a maximum temperature rating of 400°F.

**WARNING:**     *Because of the elastomeric seals required on vibrated equipment, the Bin Activator WILL NOT CONTAIN A FIRE OR EXPLOSION. If a fire is in the Bin, THE AREA SHOULD BE EVACUATED AND AVOIDED!*

3. **Isolators**

The isolators should give years of use barring chemical attack or severe overloading.

**WHEN INQUIRING ABOUT ANY BIN ACTIVATOR, ALWAYS REFER TO THE SERIAL NUMBER STAMPED ON THE METALFAB NAMEPLATE.**

**Metalfab Service**

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P.O. Box 9  
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Email: [metalfab@metalfabinc.com](mailto:metalfab@metalfabinc.com)

# Italvibras USA

## Industrial Electric Vibrators



# Model MVSI

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# Operator's Manual



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# Introduction

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Italvibras USA industrial electric vibrators have been designed and manufactured in accordance with the most exacting international industrial standards and requirements. Italvibras USA industrial electric vibrators are designed for long life at continuous duty and maximum force output. The electric vibrators are suitable for operation in ambient from -30°C to 40°C (operation outside of this range needs engineering consideration).

Italvibras USA industrial electric vibrators have been evaluated for installation throughout the world. Standard ratings include CSA (Canadian Standards Association) Approval, the CE (European Directive) Mark, EX Approval for Zone 21 (ATEX II2D tD A21 IP66), Russian GOST Mark and IECEx Approval (II2D tD A21 IP66). Check the electric vibrator nameplate for the exact ratings and Approvals for the specific Model.

The electric vibrator can be referred to by its Model or Type designation or by its Item number. The vibrator Model or Type designations referred to in this manual are as follows:

MVSI – Continuous duty industrial electric vibrator, single or three phase.

The electric vibrator may optionally be CSA Approved for Class I, Division 2, Group A, B, C and D hazardous locations, or it may be marked as being suitable for Class II, Division 2, Group F and G hazardous locations. Applications and installations requiring Division 1 equipment shall use Italvibras' CDX explosion-proof and dust-ignition-proof industrial electric vibrators.

## General Safety requirements

Read this entire manual before proceeding. Compliance with all company, local and OSHA regulations is essential. Any electrical work must be done in accordance with all applicable local and national codes and must be performed only by qualified, licensed and authorized personnel. Always follow lockout and tag out procedures and requirements and always wear ear protection when in close proximity to operating vibratory equipment.

Comprehensive adherence to these documents at a minimum is required – The National Electrical Code NFPA 70, ANSI z244.1 the American National Standard for Personnel Protection – Lockout/Tag out of Energy Sources – Minimum Safety Requirements, CFR 29 Part 1910 – Control of Hazardous Energy Sources (Lockout/Tag out) Final Rule and CFR 29 Part 1910.15 Occupational Noise Exposure.

## Storage

Storage of the electric vibrator should be in an ambient not less than 5°C with a relative humidity not more than 60%. If the vibrator has been stored for longer than two years, the vibrator should be evaluated by authorized and trained personnel to ensure that the grease is intact, that there is no bearing damage such as brinelling and that the ground insulation is sound and not damaged from condensation.

# Installation

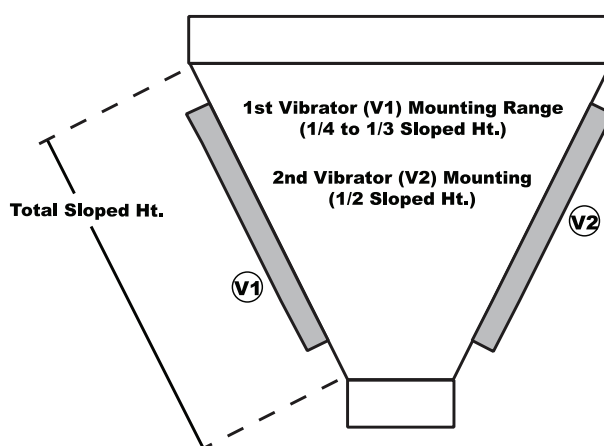
Before installing the vibrator, make sure that you have everything that you will need and that there is no shipping damage. Any product damage should be reported to the delivery service immediately. Standard metric hand tools will be needed. Carefully handle the electric vibrator. Dropping or impacting the electric vibrator may damage the bearings.

**Welding** – Never weld on a bin, hopper or machine with the electric vibrator mounted to it since the welding may damage the vibrator bearings or electrical circuits. When you do weld, especially in an enclosed area, make sure that the area is known to be nonhazardous and that there are no flammable or explosive levels of gases, vapors or dusts.

**Mounting Surface** – The object of vibration on bins and hoppers is to transmit vibration energy through the structure to the material within. The mounting surface must be rigid and strong for this transfer of energy to take place. The mounting surface must also be clean, flat (0.010 in. across mounting feet maximum), free of paint and have a minimum thickness equal to the major diameter of the mounting bolt. Also make sure that the electric vibrator feet are clean and free of debris.

## Mounting Plate

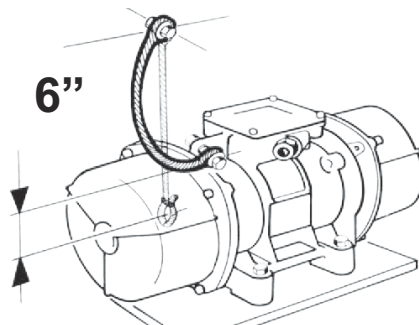
The mounting plate should be at least the overall size of the electric vibrator feet. It should be located on the bin and hopper wall at a height of  $\frac{1}{4}$  to  $\frac{1}{3}$  of the sloped wall height. The mounting plate or bracket should extend at least  $\frac{3}{4}$  the length of the sloped wall. Reference Figure 1. If a second electric vibrator is to be installed to the bin or hopper, install it at a height of  $\frac{1}{2}$  of the sloped wall height and  $180^\circ$  from the first vibrator. Weld the mounting plate or bracket to the structure wall with skip welds that are 3 in. long then skip 2 in. then 3 in. long weld, etc. Do not weld at corners of mounting plate within 1 in. of the corner.



**Figure 1. Mounting Examples**

## Safety Cable

Always install a safety cable metal rope from the electric vibrator to a reliable support should the vibrator become free from its mount and fall more than 6 in. The metal rope should be taut and positioned above the electric vibrator. Reference Figure 2.



**Figure 2.** Safety Cable Installation

## Mounting Kits

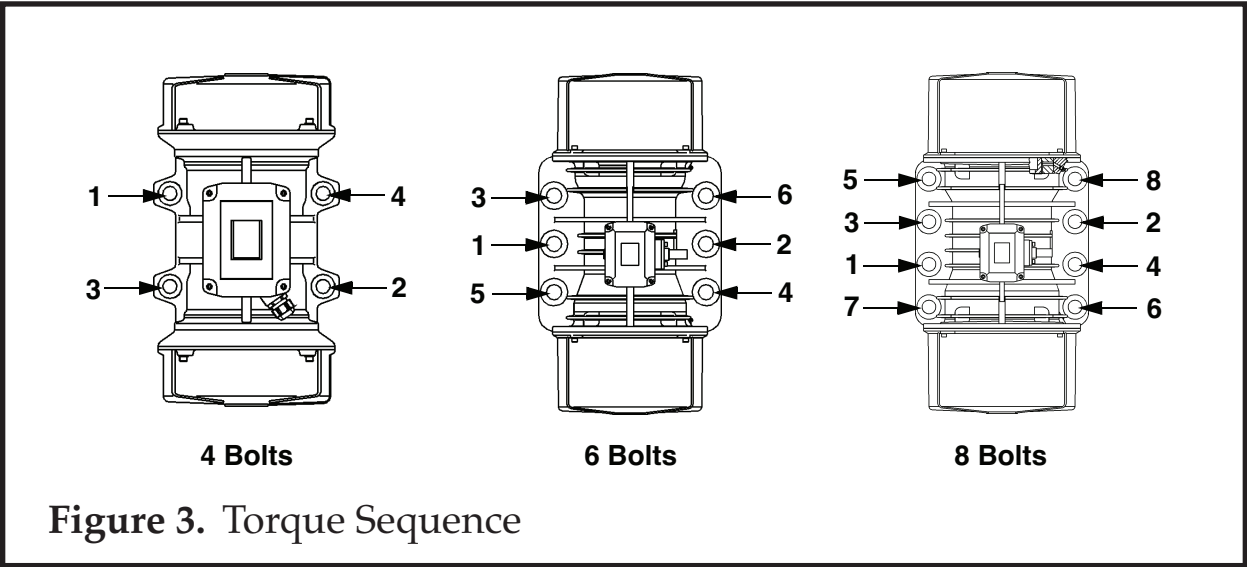
Mounting kits are available from Italtvibras USA for frame sizes 00, 01, 10, 20, 30, 40 and 50. The mounting kits include a channel mount with integral mounting plate, mounting screws and washers and safety cable kit. Contact Italtvibras USA by phone at 815-872-1350.

# Mounting Hardware & Torque

Always use new bolts, nuts and compression washers. The bolts should be Grade 5 or 8 (equivalent international designation is 8.8 and 12.9, respectively). Grade 5 bolts are suitable for a majority of applications. Do not use split lock washers. Use only compression washers. Table I offers suggested mounting bolt torque values. Always check with the bolt manufacturer for recommended torque values. Torque the mounting bolts in the proper sequence as shown in figure 3 so as not to damage casting. After operating vibrator for 15 minutes, disconnect, lockout/tag out, and torque the mounting bolts a second time. Periodically check the mounting bolt torque thereafter.

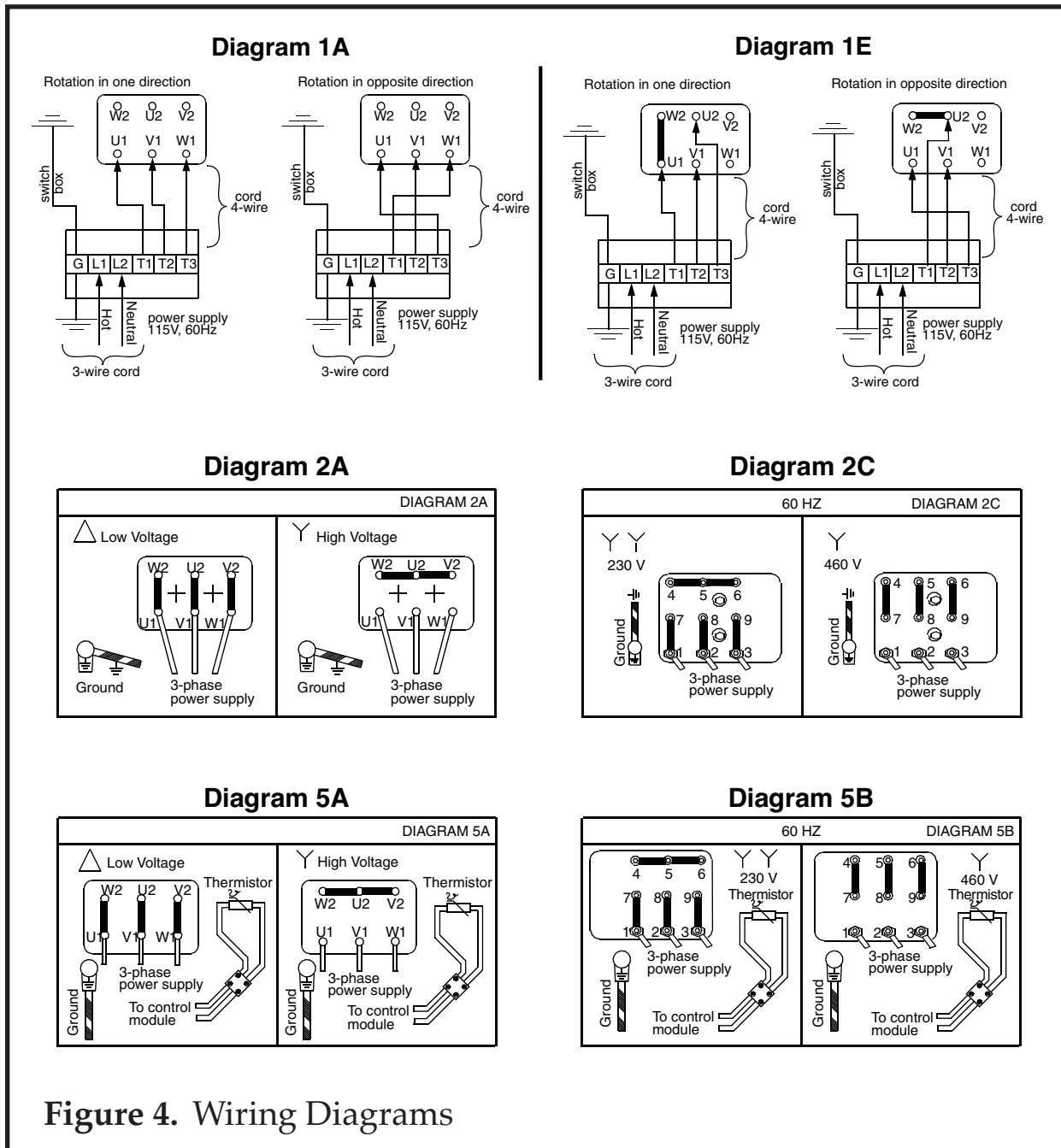
Table I. Mounting Bolts & Torque Requirements

	British		Metric	
Frame Size	Bolt Size	Dry Torque Grade 5	Bolt Size	Dry Torque Grade 8.8
00, 01	5/16 in-18 NC	16.5	M8	2.3
10, 20	1/2 in-13 NC	58	M12	8
30, 33, 35 ,40, 50	5/8 in-11 NC	137	M16	19
60	3/4 in -10 NC	288	M20	38
70	7/8 in -9 NC	430	M24	71
80	1 in-8 NC	645	M24	71
90, 95	1 in-8 NC	645	M27	89
97	1-3/8 in-8 NC	1370	M36	190
100, 105, 110	1-5/8 in-8 NC	2090	M42	290



# Wiring Electric Vibrator

It is mandatory to comply with the National Electrical Code, NFPA 70, and all applicable local codes. Identify which wiring diagram is applicable by referencing the Diagram designation on the nameplate or by referring to Table II. Remove the four screws with washers securing the wiring box cover along with the foam rubber block and set aside. Identify the wiring diagram by referencing the predetermined Diagram noted on the wiring diagram found within the wiring box or by referring to the Diagrams shown in Figure 4.



## Wiring Electric Vibrator Cont.

**Table II. Wiring Diagram Identification**

00 through 01, single-phase, 3600 rpm	Diagram 1A
10 through 30, single phase, 3600 rpm	Diagram 1E
00 through 60, three-phase, 1200, 1800 & 3600 rpm; MVSI 9-590; & 575-volt 900 rpm	Diagram 2A
40 through 60, three-phase, 900 rpm except 575V	Diagram 2C
70 through 110, three-phase, 1200, 1800 & 3600 rpm; & 575V 900 rpm	Diagram 5A
70 through 110, three-phase, 900 rpm except 575V	Diagram 5B

Select a cord type that has a voltage rating not less than the power supply voltage, that has a minimum temperature rating of 105°C, and that has an overall jacket diameter within the range specified in Table III. This table also details the cord provided by the factory for reference. We recommend Coleman black portable cord SEOWW Seoprene rated 600 V and 105°C. Coleman Cable Inc. can be reached by phone at 847-672-2300 or at [www.colemancable.com](http://www.colemancable.com). Italtvibras USA also stocks the Coleman cable.

**Table III. Cord Grip Chart**

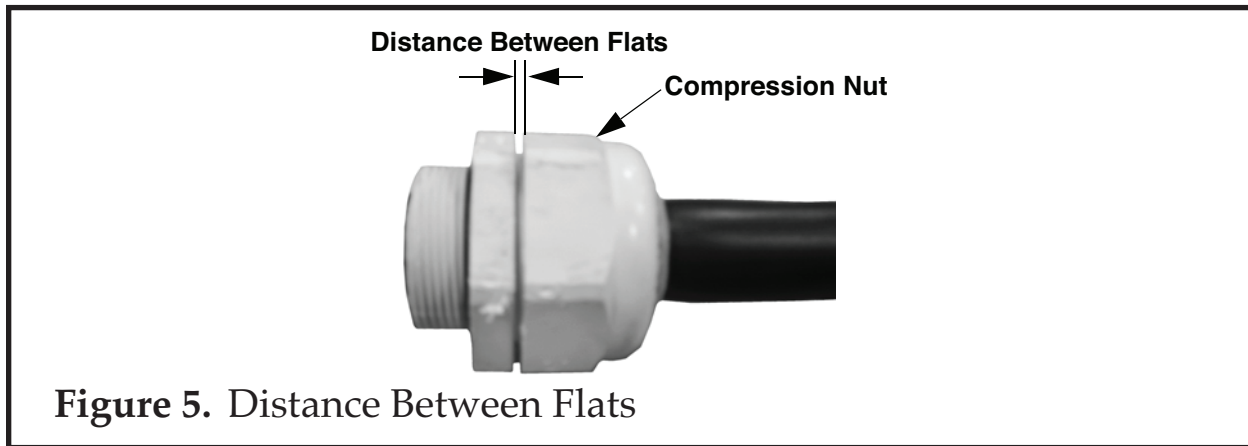
Frame Size	Size mm x 1.5	Item No.	Suitable Cord Diameter Range, mm	Cord Provided By Factory		
				Size	Nominal Diameter, in.	Distance Between Flats, in.
00, 01, 10	M20	511596	6.5-12	16/4	0.42	1/16 to 1/8
20-70	M25	511597	9-16	14/4	0.575	1/16 to 1/8
80-95	M32	511598	13-21	10/4	0.705	1/16 to 1/8
97-110	M32	511598	13-21	8/4	0.807	3/32 to 5/32
Thermistor Circuit Cord	M20	511596	6.5-12	16/3	0.39	1/16 to 1/8

When wiring the electric vibrator, leave enough slack in the cord so that the cord does not become taut during operation causing stress on the connections. It is always best to position the cord down so that should there be any moisture present the moisture would tend to run down instead of into the vibrator wiring box.

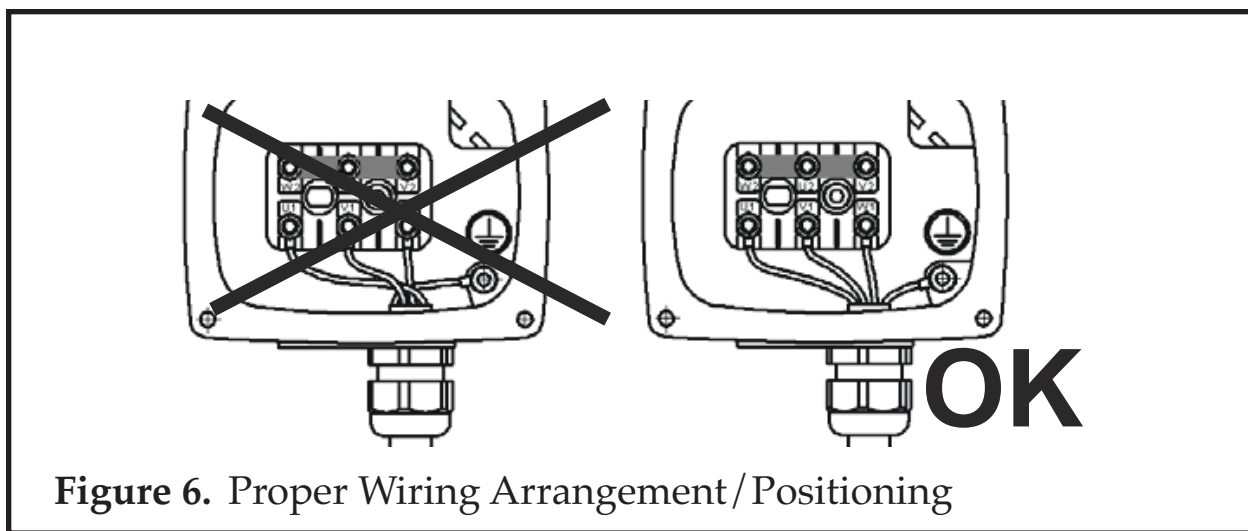
Trim the cord by removing the jacket exposing the conductors and ground wire for approx. 6 in. Be careful not to cut the conductor or ground wire insulation. Loosen the compression nut from the cord fitting assembled to the side wall of the wiring box on the electric vibrator. Position the compression nut on the cord and insert the cord through the opening in the side wall of the wiring compartment. Position the jacket of the cord approx. ½ in beyond the inside wall of the wiring box wall and secure the compression nut by threading it to a position equal to the "Distance Between Flats" noted in Table III. Reference figure 5. which pictorially defines "Distance Between Flats"



## Wiring Electric Vibrator Cont.



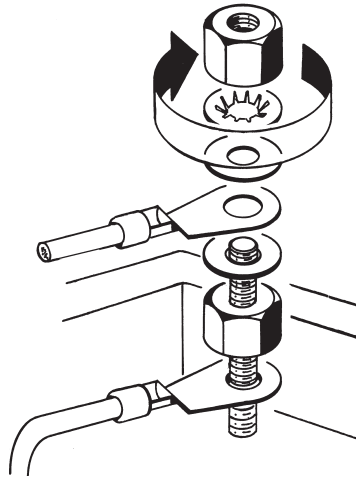
Trim the conductors within the wiring box leaving plenty of slack. Next, strip the conductor insulation for 1/4 in. to 3/8 in. Crimp on closed loop wire connectors. Use only the intended crimping tool as designated by the wire connector manufacturer. The conductors should be neatly arranged on the floor of the wiring box. The wires should not cross over each other. See figure 6.



Secure the wire connectors and the shorting bars to the terminal block in the positions shown on the wiring diagram using the hardware provided. It is essential that the hardware be positioned as shown in Figure 7.

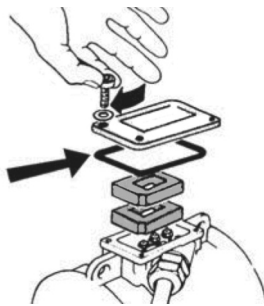
Note that the closed loop wire connectors provided on the power supply cord are positioned between the two flat washers. A drop or two of thread sealant such as Locktite is recommended. Do not use permanent thread sealant because the terminal block will be damaged should you wish to remove and replace the power supply cord. The terminal block nuts should not be over tightened since the possibility of damaging the plastic insulating body is high. Reference table VI in the Appendix for torque values. Make the connections hand-tight followed by a 1/4 turn but never put a ratchet on these nuts.

## Wiring Electric Vibrator Cont.



**Figure 7.** Terminal Block Hardware Installation

For wiring diagrams 1A, 1E, 2A and 2C (Fig.4), reinstall the rubber block over the power supply conductors and install the wiring box cover being careful not to pinch the O-ring. Screw torque is specified in the Appendix. See figure 8.



**Figure 8.** Wiring Block Assembly

For wiring diagrams 5A and 5B, you will note that there is a small 2-pole terminal block in the wiring box. This is the thermistor circuit. Proceed to Thermistor Wiring.

## Thermistor Wiring

Electric vibrators with Diagram 5A and 5B have thermistor circuits installed in the winding. These devices are intended to protect the winding from over-temperature. Connect the thermistors to the motor starter using a thermistor control module such as Siemens 3RN1012-1CK00. Never apply line voltage to the thermistor circuit. It is a low voltage +/- 5V dc circuit. The thermistor control module is connected to the motor starter control circuit which commonly operates at 120 Vac. Follow the wiring diagram provided with the thermistor control module.

The thermistors are our Item No. 0539503 and are rated 130°C. There are three PTC thermistors wired in series that are installed in the vibrator winding and connected to blue or grey leads. These leads are secured to the small 2-pole terminal block mounted in the wiring box.

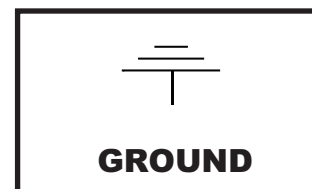
To assemble the thermistor cord, remove the threaded metal plug assembled in the side wall of the wiring box and install a M20 cord grip (our Item No. 0511596). Select a cord type that has a voltage rating not less than the power supply voltage, that has a minimum temperature rating of 105°C, and that has an overall jacket diameter within the range specified in Table III. This table also details the cord provided by the factory for reference. We recommend Coleman black portable cord SEOW Seoprene rated 600 V and 105°C. Coleman Cable Inc. can be reached by phone at 847-672-2300 or at [www.colemancable.com](http://www.colemancable.com). Italvibras USA also stocks the Coleman cable.

Trim the cord by removing the jacket exposing the conductors for approx. 6 in. Be careful not to cut the conductor wire insulation. Loosen the compression nut from the cord fitting assembled to the side wall of the wiring box on the electric vibrator. Position the compression nut on the cord and insert the cord through the opening in the side wall of the wiring compartment. Position the jacket of the cord approx. ½ in beyond the inside wall of the wiring box wall and secure the compression nut by threading it to a position equal to the "Distance Between Flats" noted in Table III. Reference figure 5 which pictorially defines "Distance Between Flats".

Trim the conductors within the wiring box leaving plenty of slack. Next, strip the conductor insulation for ¼ in. to 3/8 in. The conductors should be neatly arranged on the floor of the wiring box. The wires should not cross over each other. Secure the wires to the 2-pole terminal block by tightening the compression screws. Reinstall the rubber block over the power supply and thermistor circuit conductors and install the wiring box cover being careful not to pinch the O-ring. Screw torque is specified in the Appendix. Reference figure 8.

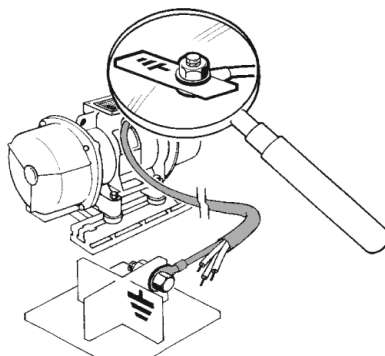
## Grounding & Bonding

The electric vibrator must be grounded using the ground wire provided in the cord. The ground wire shall be connected to a closed loop wire connector which is then connected to the ground terminal located within the wiring box (See figure 6). The ground terminal is identified by the international symbol.



It may be necessary to bond the electric vibrator to ground using the external ground screw as shown in figure 9. The external ground terminal is identified by the international symbol. Use a wire size no smaller than the internal ground wire.

## Grounding & Bonding Cont.



**Figure 9.** Ground Bonding Screw

## Overload, Short-Circuit & Ground-Fault Protection

In the USA, The National Electrical Code, NFPA 70, and all applicable local codes, govern how to properly size, select and install overload protection (sometimes called heaters) and short-circuit and ground-fault protection (fuses or circuit breakers). Proper selection and installation of these devices is required and essential for not only protection of the electric vibrator and the power supply circuit but also for protection of personnel.

If the overload or short-circuit and ground fault protection operate, have qualified personnel locate and fix the problem before resetting.

When operating two electric vibrators, the vibrators should be controlled with a single motor starter that has overload protection dedicated to each electric vibrator. The overloads shall be electrically interlocked such that should there be a fault with one electric vibrator, both electric vibrators will be de-energized.

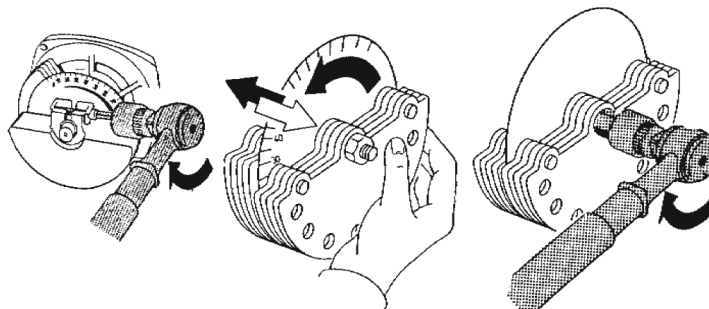
## Variable Frequency Inverter

The electric vibrators may be supplied with a variable frequency inverter. Never operate the vibrators above the maximum frequency noted on the nameplate. If operating two vibrators, use one variable frequency inverter along with overload protection dedicated to each electric vibrator. The overloads shall be electrically interlocked such that should there be a fault with one electric vibrator, both electric vibrators will be de-energized.

**The nameplate current should never be exceeded throughout the entire frequency range.**

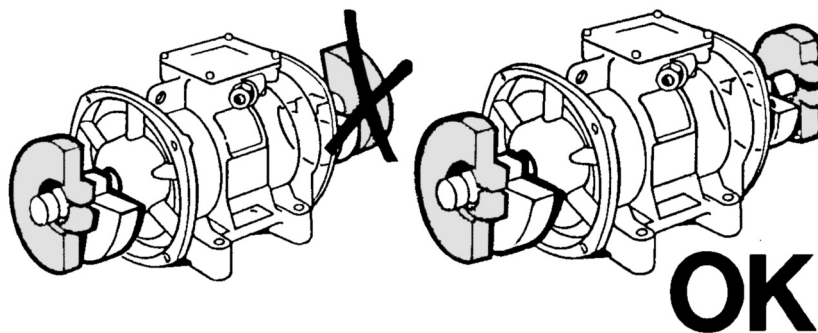
## Eccentric Weight Adjustment

The eccentric weights may be adjusted to produce the desired centrifugal force output. It is always best to operate the electric vibrator at the lowest weight setting that produces the desired result. This will result in lower energy expense and extend the bearing life. The factory setting is 50% which would result in 50% of the centrifugal force noted on the nameplate. To adjust the force output, lockout/tag out the electric vibrator. Remove each weight cover and set it and the screws, washers and O-rings aside. The outer adjustable weight clamping screw or the shaft nut may be loosened and then the adjustable weights may be rotated to the desired position. Reference Figure 10.



**Figure 10.** Eccentric Weight Adjust.

The eccentric weights must be adjusted to mirror images of each other at the same setting number as shown in Figure 11.



**Figure 11.** Setting Sets of Eccentric Weights to Mirror Images

Properly torque the clamping screw or shaft nut to secure the weights in position. Torque values are outlined in the Appendix. Reinstall the weight covers making sure not to pinch the O-rings.

## Eccentric Weight Adjustment Cont. \_\_\_\_\_

Check shaft rotation before replacing weight covers. Start vibrator for 1 second, stop and lockout/tag out. Observe direction of rotation. If desired to reverse the direction of rotation, switch two of the three power supply leads in the wiring box or at the motor starter for 3-phase electric vibrators. For 1-phase electric vibrators, refer to the wiring diagram for changing the direction of shaft rotation.

Replace weight covers using screws and washers being careful not to pinch the O-rings. The screw torque is outlined in the Appendix. Never operate the electric vibrator without weight covers in place. They provide a degree of protection for the bearings and a shield for the rotating eccentric weights. Always replace broken weight covers immediately. Do not operate electric vibrator with weight covers removed or with damaged weight covers.

## Starting Up \_\_\_\_\_

After making sure that the power supply voltage matches the voltage marked on the nameplate, that the mounting bolts are properly secured, that all covers are in place and secured, and that the motor starter is properly installed and adjusted, turn the electric vibrator on. Excessive noise would indicate a problem but slight bearing noise is normal due to the type of bearing used. After a few hours of operation, check each line current and verify that it does not exceed nameplate current. If the line current exceeds the nameplate current, then the mount needs to be stiffened, the vibrator weights need to be reduced or the vibrator needs to be moved to a more rigid location. Never operate the vibrator above nameplate current.

After the first 8 hours of operation, check the line current to make sure that it does not exceed nameplate and check mounting bolt torque. See MOUNTING HARDWARE AND TORQUE.

# Electric Vibrator Lubrication

All electric vibrators are lubricated at the factory. If there are no external grease fittings, then the vibrator construction is lubricated for life. No grease ever need be added to these electric vibrators. If external grease fittings are provided, then it is intended that the bearings be periodically lubricated. The lubrication schedule is outlined in Table IV.

**Table IV. Lubrication Schedule For Each Bearing**

Lubricate every 2000 hours unless specified otherwise.

00 Frame		01 Frame		10 Frame		20 Frame		30 Frame		33 Frame	
Model	Grease, g	Model	Grease, g	Model	Grease, g	Model	Grease, g	Model	Grease, g	Model	Grease, g
MVSI 36-380	Life	MVSI 36-480	Life	MVSI 36-660	Life	MVSI 36-1050	Life	MVSI 36-1680	Life	MVSI 36-2900	Life
MVSI 18-100	Life	MVSI 18-180	Life	MVSI 18-480	Life	MVSI 36-1500	Life	MVSI 18-1690	Life	MVSI 36-3500	9
		MVSI 18-250	Life	MVSI 12-110	Life	MVSI 18-920	Life	MVSI 18-2280	Life		
				MVSI 12-300	Life	MVSI 18-1310	Life	MVSI 12-760	Life		
						MVSI 12-580	Life	MVSI 9-590	Life		
						MVSI 9-340	Life				

35 Frame		40 Frame		50 Frame		60 Frame		70 Frame		80 Frame	
Model	Grease, g	Model	Grease, g	Model	Grease, g	Model	Grease, g	Model	Grease, g	Model	Grease, g
MVSI 36-2530	7	MVSI 18-3190	9	MVSI 36-3280	9	MVSI 13-5380	19	MVSI 36-6860	26	MVSI 18-10900	40
MVSI 18-2150	7	MVSI 12-1990	Life	MVSI 36-4080	Life	MVSI 18-6850	19	MVSI 36-8240	26	MVSI 18-13400	40
MVSI 12-1630	Life	MVSI 9-1440	Life	MVSI 36-4100	16	MVSI 12-3410	Life	MVSI 36-11000	30*	MVSI 12-8450	30
MVSI 12-1660	Life			MVSI 36-4910	16	MVSI 12-4700	Life	MVSI 18-8300	26	MVSI 12-10400	40
MVSI 9-910	Life			MVSI 18-3870	16	MVSI 9-2920	Life	MVSI 18-9420	26	MVSI 12-11400	40
MVSI 9-1160	Life			MVSI 18-4500	16	MVSI 9-3850	Life	MVSI 12-6050	18	MVSI 9-6830	30
				MVSI 12-2540	Life			MVSI 12-6600	18	MVSI 9-8400	40
				MVSI 12-3110	Life			MVSI 9-4640	18		
				MVSI 9-2030	Life						

\* - Lubricate Every 750 Hours

\*\* - Lubricate Every 200 Hours



**Table IV. Lubrication Schedule For Each Bearing Cont.**  
 Lubricate every 2000 hours unless specified otherwise.

<b>90 Frame</b>		<b>95 Frame</b>		<b>97 Frame</b>		<b>100 Frame</b>		<b>105 Frame</b>		<b>110 Frame</b>	
<b>Model</b>	<b>Grease, g</b>	<b>Model</b>	<b>Grease, g</b>	<b>Model</b>	<b>Grease, g</b>	<b>Model</b>	<b>Grease, g</b>	<b>Model</b>	<b>Grease, g</b>	<b>Model</b>	<b>Grease, g</b>
MVSI 36-14000	20**	MVSI 36-20000	25**	MVSI 18-19700	90	MVSI 18-25300	130	MVSI 12-31000	150	MVSI 12-45000	220
MVSI 18-14500	60	MVSI 18-17600	80	MVSI 12-14500	60	MVSI 18-32900	150	MVSI 12-37000	180	MVSI 12-55000	TBD
MVSI 12-11700	50	MVSI 12-17600	80	MVSI 12-20100	90	MVSI 12-26500	130	MVSI 12-40000	180	MVSI 9-49000	220
MVSI 12-12300	50	MVSI 12-19100	80	MVSI 12-24400	90	MVSI 9-24800	130	MVSI 9-31000	150	MVSI 9-57000	TBD
MVSI 12-14400	60	MVSI 9-14400	80	MVSI 12-29000	130			MVSI 9-38000	180		
MVSI 12-15400	60			MVSI 9-14500	60						
MVSI 9-9310	50			MVSI 9-21900	90						
MVSI 9-11700	60										

<b>120 Frame</b>	
<b>Model</b>	<b>Grease, g</b>
MVSI 12-67000	260
MVSI 9-67100	260

\* - Lubricate Every 750 Hours  
 \*\* - Lubricate Every 200 Hours

The lubrication frequency is every 2000 hours of operation unless specified otherwise in the table. There is an exception - 3600 rpm electric vibrators operating continuously or for long periods of time should be lubricated in ½ the time specified using ½ the grease volume specified. For all other vibrators, follow the table except when the operating temperature exceeds 90°C. If the operating temperature exceeds 90°C, reduce the lubrication frequency and lubrication volume by 50% for every 10°C increment above 90°C. If the electric vibrator operating temperature exceeds 100°C, contact Italvibras USA by phone at 815-872-1350. The electric vibrator should never operate above 120°C.

When adding grease through the grease fitting, make sure to clean the fitting so as not to introduce dirt into the bearing. Add the specified amount of grease. Experiment with your grease gun to determine how many grams are introduced with each pump. Never over-grease a bearing since this will damage the bearing and cause high operating temperature.

Always use the correct grease. Never mix greases. Use Kluber NBU 15 grease in all MVSI 36 electric vibrators. All other electric vibrators are lubricated with Kluber NBU 8EP grease. Kluber grease may be purchased direct from Kluber Lubrication by calling 800-447-2238. Italvibras USA also stocks the Kluber grease.

## Electric Vibrator Repair

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If the electric vibrator needs repair, contact Italvibras USA at 815-872-1350 for instructions. Most electric motor repair shops are not trained to repair our industrial electric vibrators. We recommend that they be returned to the service center located in Princeton, IL. Attempting to repair the electric vibrator or replace the bearings will void the warranty.

## Electric Vibrator Maintenance

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Every quarter, we recommend a thorough inspection of the electric vibrator. After lockout / tag out, do the following:

- 1.) Inspect the cord for any visible damage or wear. Replace the cord if there are any signs of damage or wear. This holds true for both the power supply cord and the thermistor circuit cord.
- 2.) Remove the wiring box cover and inspect for any foreign matter or liquid. Vacuum any foreign matter. If wet, remove electric vibrator from service and have the ground insulation tested by a trained, qualified and licensed technician.
- 3.) Before replacing the wiring box cover, make sure the electrical connections are tight (do not over-tighten) and inspect the cover O-ring and rubber compression block. If the O-ring or rubber compression block is damaged or if they have lost their compression set, replace them.
- 4.) Remove each weight cover and inspect for foreign matter. Vacuum if necessary. Replace O-rings if they are damaged or if they have lost their compression set.
- 5.) Check the mounting bolt torque.
- 6.) Replace any broken parts.

# Appendix

## Electric Vibrator Item Numbers

The table below outlines a list of electric vibrator Model/Type designations next to their respective Item No. The information is sorted by frame size. Please reference the Model/Type designation and Item No. when ordering electric vibrators or their parts.

**Table V. Vibrator Item Numbers By Frame**

00 Frame		01 Frame		10 Frame		20 Frame		30 Frame		33 Frame	
Model	Item No.	Model	Item No.	Model	Item No.	Model	Item No.	Model	Item No.	Model	Item No.
MVSI 36-380	600311	MVSI 36-480	600312	MVSI 36-660	600313	MVSI 36-1050	600314	MVSI 36-1680	600381	MVSI 36-2900	600491
MVSI 18-100	601340	MVSI 18-180	601341	MVSI 18-480	601367	MVSI 36-1500	600366	MVSI 18-1690	601408	MVSI 36-3500	600504
		MVSI 18-250	601366	MVSI 12-110	602296	MVSI 18-920	601372	MVSI 18-2280	601513		
				MVSI 12-300	602297	MVSI 18-1310	601373	MVSI 12-760	602314		
						MVSI 12-580	602298	MVSI 9-590	602575		
						MVSI 9-340	602568				

35 Frame		40 Frame		50 Frame		60 Frame		70 Frame		80 Frame	
Model	Item No.	Model	Item No.	Model	Item No.	Model	Item No.	Model	Item No.	Model	Item No.
MVSI 36-2530	600513	MVSI 18-3190	601217	MVSI 36-3280	600502	MVSI 13-5380	601220	MVSI 36-6860	600470	MVSI 18-10900	601211
MVSI 18-2150	601524	MVSI 12-1990	602380	MVSI 36-4080	600503	MVSI 18-6850	601268	MVSI 36-8240	600471	MVSI 18-13400	601447
MVSI 12-1630	602402	MVSI 9-1440	602609	MVSI 36-4100	600256	MVSI 12-3410	602406	MVSI 36-11000	600472	MVSI 12-8450	602154
MVSI 12-1660	602403			MVSI 36-4910	600257	MVSI 12-4700	602407	MVSI 18-8300	601221	MVSI 12-10400	602204
MVSI 9-910	602615			MVSI 18-3870	601219	MVSI 9-2920	602618	MVSI 18-9420	601269	MVSI 12-11400	602350
MVSI 9-1160	602616			MVSI 18-4500	601267	MVSI 9-3850	602619	MVSI 12-6050	602167	MVSI 9-6830	602884
				MVSI 12-2540	602381			MVSI 12-6600	602230	MVSI 9-8400	602515
				MVSI 12-3110	602382			MVSI 9-4640	602891		
				MVSI 9-2030	602610						

# Electric Vibrator Item Numbers Cont.

Table V. Vibrator Item Numbers By Frame Cont.

90 Frame		95 Frame		97 Frame		100 Frame		105 Frame		110 Frame	
Model	Item No.	Model	Item No.	Model	Item No.	Model	Item No.	Model	Item No.	Model	Item No.
MVSI 36-14000	600276	MVSI 36-20000	600201	MVSI 18-19700	601204	MVSI 18-25300	601205	MVSI 12-31000	602142	MVSI 12-45000	602144
MVSI 18-14500	601165	MVSI 18-17600	601166	MVSI 12-14500	602136	MVSI 18-32900	601271	MVSI 12-37000	602143	MVSI 12-55000	602273
MVSI 12-11700	602138	MVSI 12-17600	602092	MVSI 12-20100	602137	MVSI 12-26500	602134	MVSI 12-40000	602244	MVSI 9-49000	602873
MVSI 12-12300	602351	MVSI 12-19100	602093	MVSI 12-24400	602349	MVSI 9-24800	602863	MVSI 9-31000	602871	MVSI 9-57000	602535
MVSI 12-14400	602091	MVSI 9-14400	602827	MVSI 12-29000	602227			MVSI 9-38000	602872		
MVSI 12-15400	602352			MVSI 9-14500	602551						
MVSI 9-9310	602862			MVSI 9-21900	602870						
MVSI 9-11700	602826										

120 Frame	
Model	Item No.
MVSI 12-67000	602336
MVSI 9-67100	602589

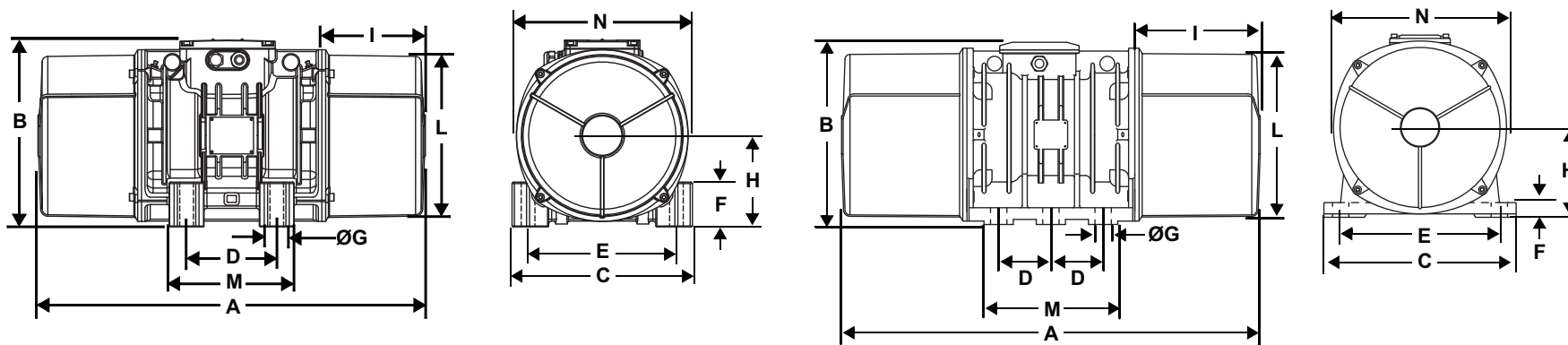
## Electric Vibrator Torque Requirements \_\_\_\_\_

Table VI. Vibrator Nut & Screw Torque Requirements

Cap Screws	ft/lb (kgm)	Shaft Nuts	ft/lb (kgm)	Terminal Block Nuts	ft/lb (kgm)
M6	7 (1)	M13x1	22 (3)	M4	0.87 (0.12)
M8	16.5 (2.3)	M15x1	36 (5)	M5	1.45 (0.20)
M10	35 (4.8)	M20x1	72 (10)	M6	2.17 (0.30)
M12	58 (8)	M25x1.5	123 (17)	M8	4.70 (0.65)
M14	95 (13)	M30x1.5	246 (34)	M10	9.80 (1.35)
M16	137 (19)	M45x1.5	360 (50)		
M18	195 (27)				
M20	275 (38)				

# Electric Vibrator Dimensions (in./mm)

Table VI. Vibrator Dimensions By Frame



Frame Size	A	B	C	D	E	F	Foot Holes		H	I	L	M	N
							ØG	No.					
00	8.31 (211)	6.02 (153)	4.92 (125)	2.44-2.84 (62-72)	4.17 (106)	0.94 (24)	0.35 (9)	4	2.40 (61)	1.83 (47)	4.06 (103)	3.94 (100)	4.61 (117)
01	9.25 (235)	6.02 (153)	4.92 (125)	2.44-2.84 (62-72)	4.17 (106)	0.94 (24)	0.35 (9)	4	2.40 (61)	2.28 (58)	4.06 (103)	3.94 (100)	4.61 (117)
10	11.83 (301)	7.05 (179)	5.98 (152)	3.54 (90)	4.92 (125)	1.10 (28)	0.51 (13)	4	2.87 (73)	3.03 (77)	5.00 (127)	5.04 (128)	5.55 (141)
20	13.54 (344)	7.99 (203)	6.57 (167)	4.13 (105)	5.51 (140)	1.18 (30)	0.51 (13)	4	3.25 (83)	3.68 (94)	5.71 (145)	5.51 (140)	6.30 (160)
30	15.00 (381)	8.27 (210)	8.07 (205)	4.72 (120)	6.69 (170)	1.77 (45)	0.67 (17)	4	3.60 (91)	3.46 (88)	6.61 (168)	6.30 (160)	6.93 (176)
33	14.21 (361)	8.39 (213)	8.46 (215)	3.94 (100)	7.09 (180)	1.54 (39)	0.67 (17)	4	3.60 (91)	2.56 (65)	6.30 (160)	5.51 (140)	6.89 (175)
35	17.13 (435)	9.17 (233)	8.07 (205)	4.72 (120)	6.69 (170)	2.13 (54)	0.67 (17)	4	4.11 (104)	4.63 (118)	7.36 (187)	6.38 (162)	7.99 (203)
40	19.69 (500)	9.75 (248)	9.06 (230)	5.51 (140)	7.48 (190)	2.13 (54)	0.67 (17)	4	4.57 (116)	5.28 (134)	8.27 (210)	7.09 (180)	8.86 (225)
50	22.36 (568)	9.69 (246)	9.06 (230)	5.51 (140)	7.48 (190)	2.13 (54)	0.67 (17)	4	4.57 (116)	6.61 (168)	8.27 (210)	7.09 (180)	8.86 (225)
60	24.29 (617)	10.94 (278)	10.83 (275)	6.10 (155)	8.86 (225)	2.76 (70)	0.87 (22)	4	5.31 (135)	6.97 (177)	9.37 (238)	8.07 (205)	9.96 (253)
70	26.22 (666)	12.64 (321)	12.20 (310)	6.10 (155)	10.04 (255)	3.03 (77)	0.93 (24)	4	6.18 (157)	7.01 (178)	10.91 (277)	8.46 (215)	11.61 (295)
80	28.74 (730)	13.66 (347)	13.39 (340)	7.09 (180)	11.02 (280)	3.15 (80)	1.02 (26)	4	6.50 (165)	7.87 (200)	12.01 (305)	9.45 (240)	12.60 (320)
90	29.13 (740)	14.57 (370)	15.35 (390)	7.87 (200)	12.60 (320)	3.78 (96)	1.10 (28)	4	7.56 (192)	9.45 (240)	12.99 (330)	10.63 (270)	13.78 (350)
95	34.25 (870)	15.55 (395)	15.43 (392)	7.87 (200)	12.60 (320)	4.13 (105)	1.10 (28)	4	7.56 (192)	10.04 (255)	13.98 (355)	10.63 (270)	14.76 (375)
97	39.45 (1002)	17.17 (436)	18.11 (460)	4.92 (125)	14.96 (380)	1.38 (35)	1.50 (38)	6	8.46 (215)	11.81 (300)	16.30 (414)	12.60 (320)	17.52 (445)
100	42.13 (1070)	17.87 (454)	20.87 (530)	5.51 (140)	17.32 (440)	1.50 (38)	1.73 (44)	6	9.06 (230)	11.02 (280)	17.64 (448)	14.57 (370)	18.39 (467)
105	44.09 (1120)	20.71 (526)	22.44 (570)	5.51 (140)	18.90 (480)	1.61 (41)	1.77 (45)	8**	10.55 (265)	11.02 (280)	19.49 (495)	20.08 (510)	20.31 (516)
110	45.28 (1150)	23.90 (607)	24.02 (610)	5.51 (140)	20.47 (520)	1.50 (38)	1.77 (45)	8**	11.69 (297)	11.71 (297)	21.34 (542)	21.85 (555)	22.91 (582)

\*Dimensions given are maximum for each frame size and will vary depending on the rpm of the vibrator.

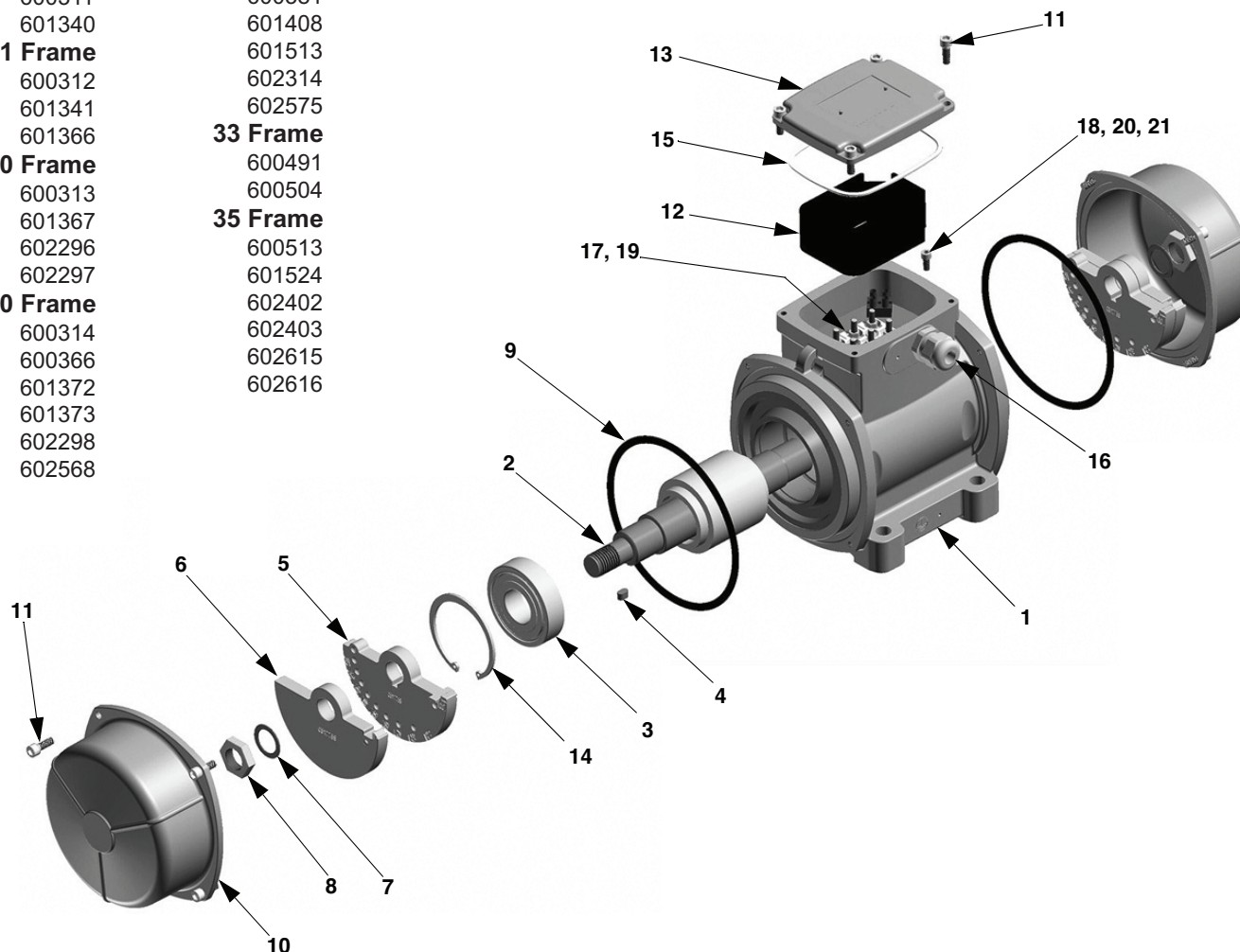
\*\*105 and 110 frame vibrators have 8 mounting holes (not pictured).

**Part# --Description**

1	-CASE
2	-STATOR
3	-BEARING FLANGE
4	-SCREW
5	-SCHNORR WASHER
6	-O-RING
7	-SHAFT
8	-FLANGE ADAPTER
9	-SHAFT WASHER
10	-BEARING
11	-BEARING COVER
12	-SHAFT SEAL
13	-SHFT KEY
14	-FIXED WEIGHT
15	-ADJUSTABLE WEIGHT
16	-SCREW
17	-SCHNORR WASHER
18	-BRASS WASHER
19	-WEIGHT ADJUSTMENT DISC
20	-EXTERNAL SNAP RING
21	-SHAFT NUT
22	-O-RING
23	-WEIGHT COVER
24	-SCREW
25	-SCHNORR WASHER
26	-TERMINAL BLOCK
27	-SCREW
28	-SCHNORR WASHER
29	-GROUND SCREW
30	-SCHNORR WASHER
31	-GROUND LABEL
32	-RUBBER COMPRESSION BLOCK
33	-O-RING
34	-WIRING BOX COVER
35	-SCREW
36	-SCHNORR WASHER
37	-CORD GRIP
38	-GREASE FITTING/PLUG
39	-LEAD PROTECTOR
40	-INTERNAL SNAP RING
41	-SCHNORR WASHER
42	-SHAFT SEAL
45	-FAN
46	-BEARING COVER
47	-SCREW
48	-SCHNORR WASHER
49	-THERMISTOR TERMINAL BLOCK
50	-SCREW
51	-ADAPTER SCREW
52	-PLUG
53	-SCREW
54	-SCHNORR WASHER
55	-SCHNORR WASHER
59	-SPACER
60	-SCREW
61	-WIRING BOX COVER
64	-SCREW
66	-GREASE SEAL RING
67	-SPLIT WEIGHT COVER
71	-SHAFT SEAL
75	-WEIGHT SPACER

**Item Numbers;**

<b>00 Frame</b>	<b>30 Frame</b>
600311	600381
601340	601408
<b>01 Frame</b>	601513
600312	602314
601341	602575
601366	<b>33 Frame</b>
<b>10 Frame</b>	600491
600313	600504
601367	<b>35 Frame</b>
602296	600513
602297	601524
<b>20 Frame</b>	602402
600314	602403
600366	602615
601372	602616
601373	
602298	
602568	



**Part# --Description**

1	- CASE
2	- STATOR
3	- BEARING FLANGE
4	- SCREW
5	- SCHNORR WASHER
6	- O-RING
7	- SHAFT
8	- FLANGE ADAPTER
9	- SHAFT WASHER
10	- BEARING
11	- BEARING COVER
12	- SHAFT SEAL
13	- SHIFT KEY
14	- FIXED WEIGHT
15	- ADJUSTABLE WEIGHT
16	- SCREW
17	- SCHNORR WASHER
18	- BRASS WASHER
19	- WEIGHT ADJUSTMENT DISC
20	- EXTERNAL SNAP RING
21	- SHAFT NUT
22	- O-RING
23	- WEIGHT COVER
24	- SCREW
25	- SCHNORR WASHER
26	- TERMINAL BLOCK
27	- SCREW
28	- SCHNORR WASHER
29	- GROUND SCREW
30	- SCHNORR WASHER
31	- GROUND LABEL
32	- RUBBER COMPRESSION BLOCK
33	- O-RING
34	- WIRING BOX COVER
35	- SCREW
36	- SCHNORR WASHER
37	- CORD GRIP
38	- GREASE FITTING/PLUG
39	- LEAD PROTECTOR
40	- INTERNAL SNAP RING
41	- SCHNORR WASHER
42	- SHAFT SEAL
45	- FAN
46	- BEARING COVER
47	- SCREW
48	- SCHNORR WASHER
49	- THERMISTOR TERMINAL BLOCK
50	- SCREW
51	- ADAPTER SCREW
52	- PLUG
53	- SCREW
54	- SCHNORR WASHER
55	- SCHNORR WASHER
59	- SPACER
60	- SCREW
61	- WIRING BOX COVER
64	- SCREW
66	- GREASE SEAL RING
67	- SPLIT WEIGHT COVER
71	- SHAFT SEAL
75	- WEIGHT SPACER

**Item Numbers;****40 Frame**

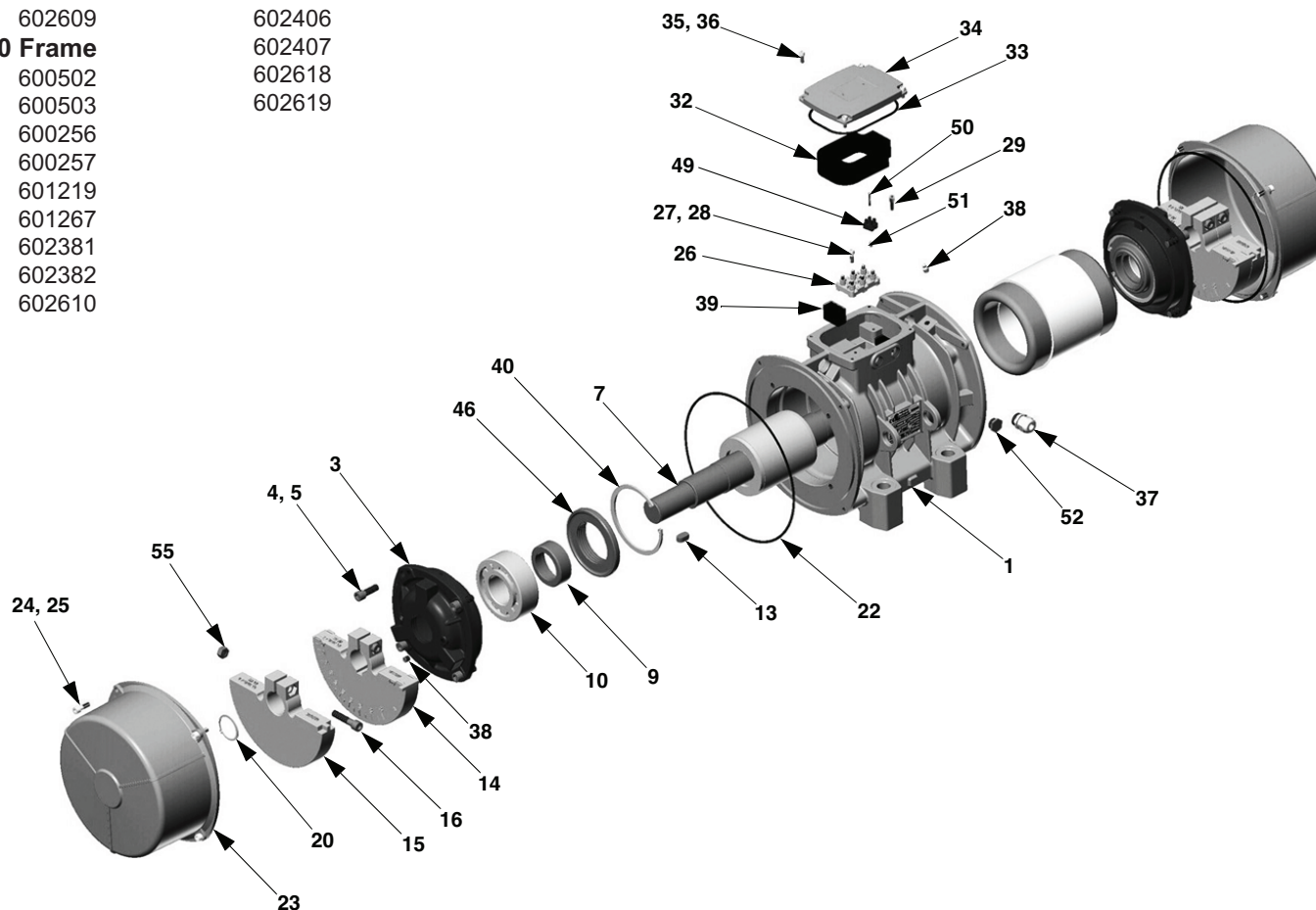
601217  
602380  
602609  
600502  
600503  
600256  
600257  
601219  
601267  
602381  
602382  
602610

**60 Frame**

601220  
601268  
602406  
602407  
602618  
602619

**50 Frame**

600502  
600503  
600256  
600257  
601219  
601267  
602381  
602382  
602610





**Part# --Description**

1	-CASE
2	-STATOR
3	-BEARING FLANGE
4	-SCREW
5	-SCHNORR WASHER
6	-O-RING
7	-SHAFT
8	-FLANGE ADAPTER
9	-SHAFT WASHER
10	-BEARING
11	-BEARING COVER
12	-SHAFT SEAL
13	-SHFT KEY
14	-FIXED WEIGHT
15	-ADJUSTABLE WEIGHT
16	-SCREW
17	-SCHNORR WASHER
18	-BRASS WASHER
19	-WEIGHT ADJUSTMENT DISC
20	-EXTERNAL SNAP RING
21	-SHAFT NUT
22	-O-RING
23	-WEIGHT COVER
24	-SCREW
25	-SCHNORR WASHER
26	-TERMINAL BLOCK
27	-SCREW
28	-SCHNORR WASHER
29	-GROUND SCREW
30	-SCHNORR WASHER
31	-GROUND LABEL
32	-RUBBER COMPRESSION BLOCK
33	-O-RING
34	-WIRING BOX COVER
35	-SCREW
36	-SCHNORR WASHER
37	-CORD GRIP
38	-GREASE FITTING/PLUG
39	-LEAD PROTECTOR
40	-INTERNAL SNAP RING
41	-SCHNORR WASHER
42	-SHAFT SEAL
45	-FAN
46	-BEARING COVER
47	-SCREW
48	-SCHNORR WASHER
49	-THERMISTOR TERMINAL BLOCK
50	-SCREW
51	-ADAPTER SCREW
52	-PLUG
53	-SCREW
54	-SCHNORR WASHER
55	-SCHNORR WASHER
59	-SPACER
60	-SCREW
61	-WIRING BOX COVER
64	-SCREW
66	-GREASE SEAL RING
67	-SPLIT WEIGHT COVER
71	-SHAFT SEAL
75	-WEIGHT SPACER

**Item Numbers;****70 Frame**

600470  
600471  
600472  
601221  
601269  
602167  
602230  
602891  
601211  
601447  
602154  
602204  
602350  
602884  
602515

**80 Frame****90 Frame**

600276  
601165  
602138  
602351  
602091  
602352  
602862  
602826

**95 Frame**

600201  
601166  
602092  
602093  
602827  
602827  
601204  
602136  
602137  
602349  
602227  
602551  
602870

**97 Frame****100 Frame**

601205  
601271  
602134  
602863

**105 Frame**

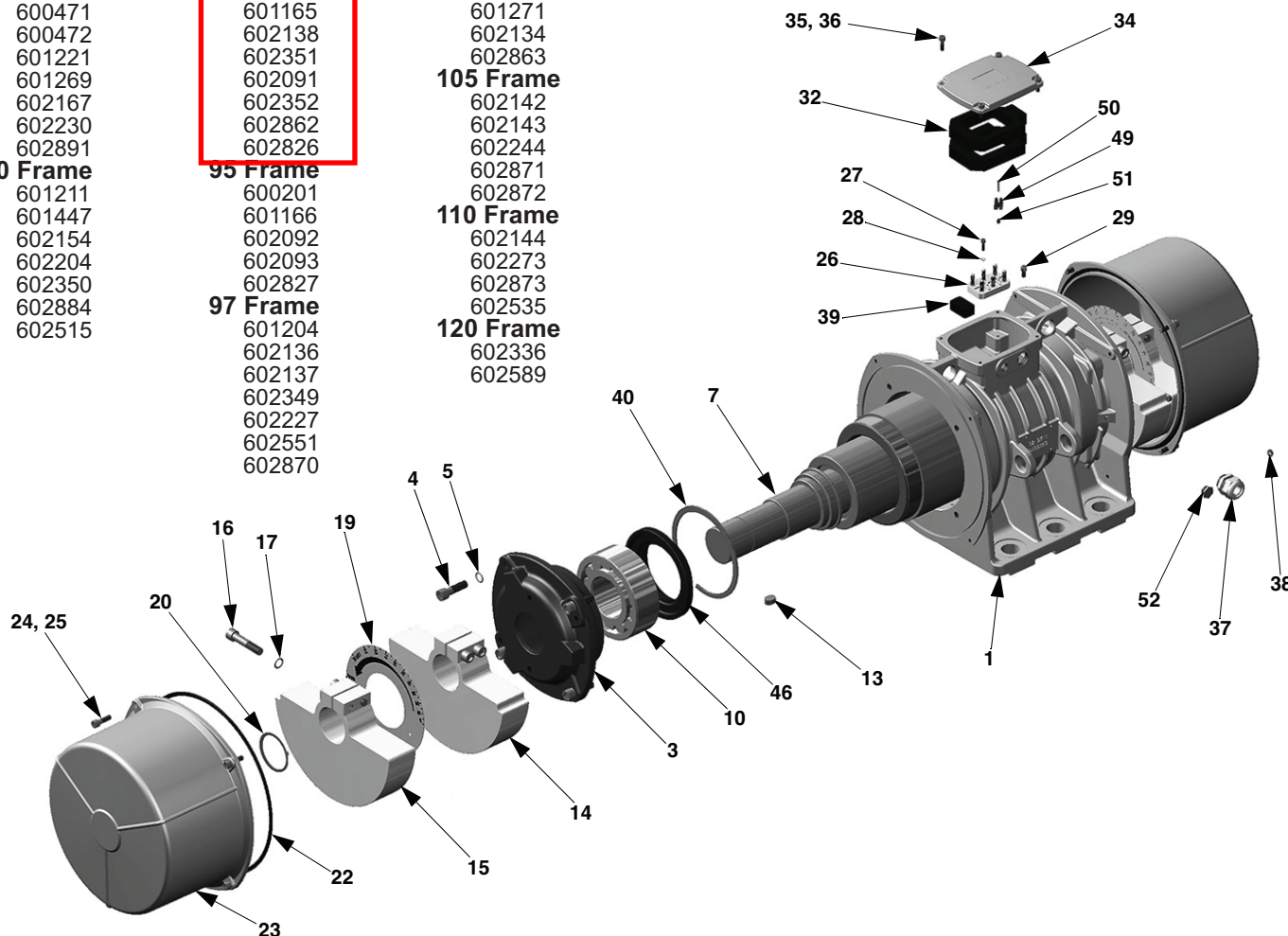
602142  
602143  
602244  
602871  
602872

**110 Frame**

602144  
602273  
602873  
602535

**120 Frame**

602336  
602589





# Order Information\_\_\_\_\_

When ordering, please specify the following:

Vibrator Model \_\_\_\_\_

Series \_\_\_\_\_

Serial number \_\_\_\_\_

Voltage, frequency & number of phases \_\_\_\_\_

Part#/Description	Quantity Required	Part#/Description	Quantity Required
1 CASE _____		32 RUBBER COMPRESSION BLOCK _____	
2 STATOR _____		33 O-RING _____	
3 BEARING FLANGE _____		34 WIRING BOX COVER _____	
4 SCREW _____		35 SCREW _____	
5 SCHNORR WASHER _____		36 SCHNORR WASHER _____	
6 O-RING _____		37 CORD GRIP _____	
7 SHAFT _____		38 GREASE FITTING/PLUG _____	
8 FLANGE ADAPTER _____		39 LEAD PROTECTOR _____	
9 SHAFT WASHER _____		40 INTERNAL SNAP RING _____	
10 BEARING _____		41 SCHNORR WASHER _____	
11 BEARING COVER _____		42 SHAFT SEAL _____	
12 SHAFT SEAL _____		45 FAN _____	
13 SHFT KEY _____		46 BEARING COVER _____	
14 FIXED WEIGHT _____		47 SCREW _____	
15 ADJUSTABLE WEIGHT _____		48 SCHNORR WASHER _____	
16 SCREW _____		49 THERMISTOR TERMINAL BLOCK _____	
17 SCHNORR WASHER _____		50 SCREW _____	
18 BRASS WASHER _____		51 ADAPTER SCREW _____	
19 WEIGHT ADJUSTMENT DISC _____		52 PLUG _____	
20 EXTERNAL SNAP RING _____		53 SCREW _____	
21 SHAFT NUT _____		54 SCHNORR WASHER _____	
22 O-RING _____		55 SCHNORR WASHER _____	
23 WEIGHT COVER _____		59 SPACER _____	
24 SCREW _____		60 SCREW _____	
25 SCHNORR WASHER _____		61 WIRING BOX COVER _____	
26 TERMINAL BLOCK _____		64 SCREW _____	
27 SCREW _____		66 GREASE SEAL RING _____	
28 SCHNORR WASHER _____		67 SPLIT WEIGHT COVER _____	
29 GROUND SCREW _____		71 SHAFT SEAL _____	
30 SCHNORR WASHER _____		75 WEIGHT SPACER _____	
31 GROUND LABEL _____			

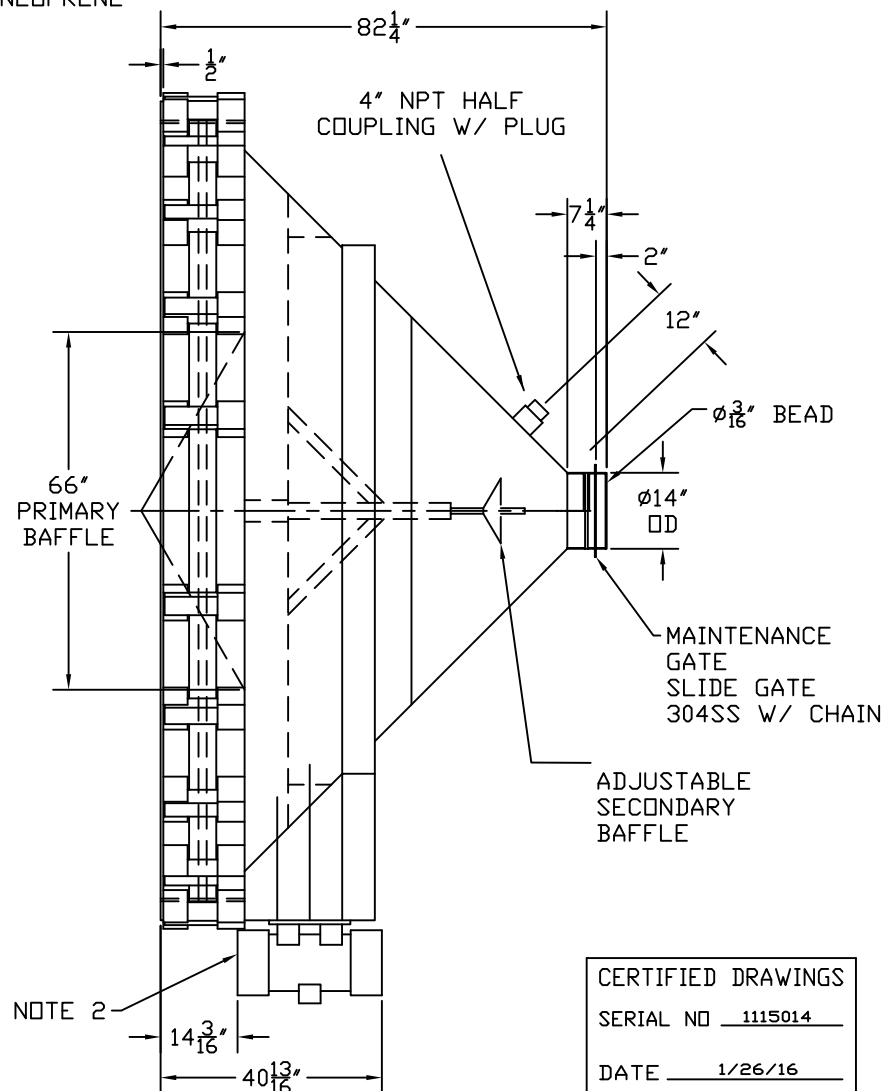
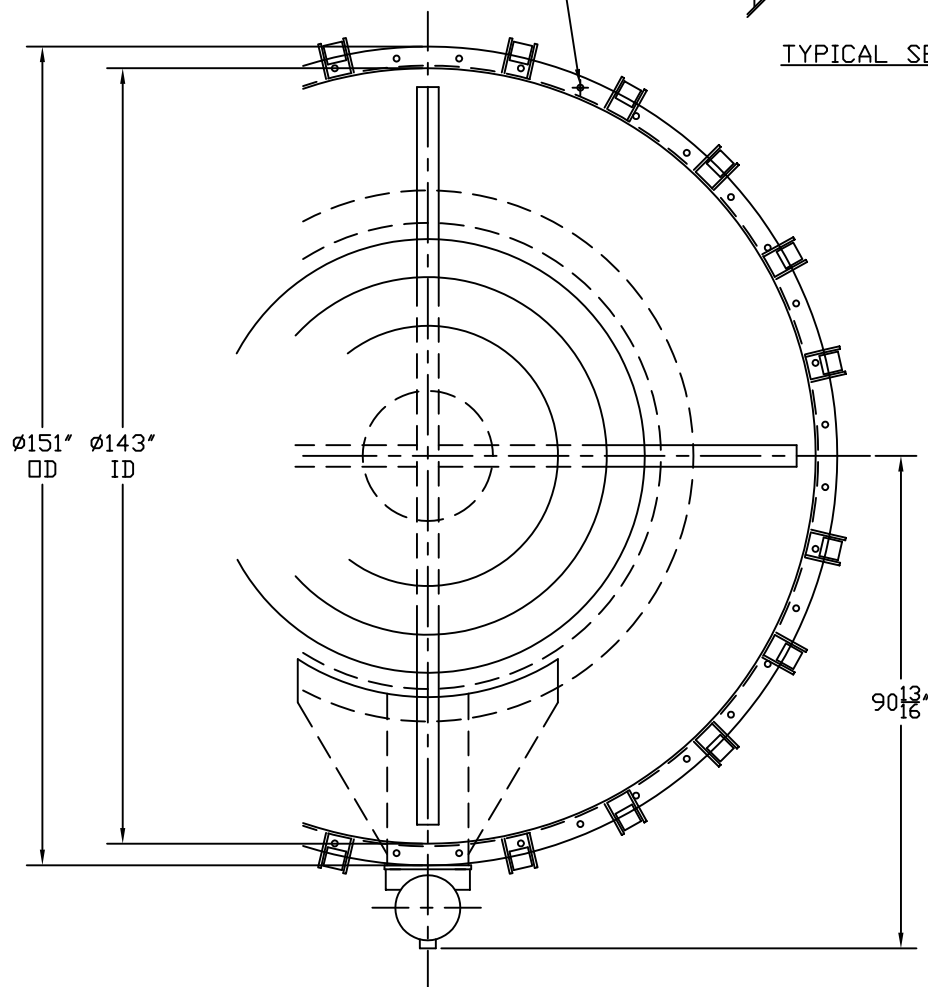
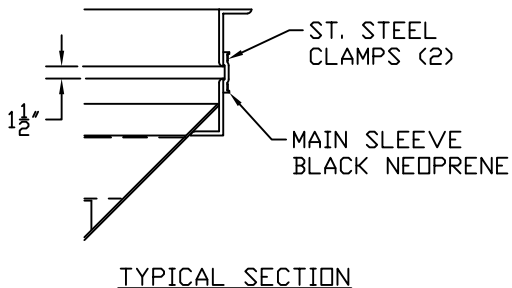
Fax, Phone or E-Mail to:



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 Princeton, IL 61356  
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 f. 866-337-2693  
 parts@italvibrasusa.com  
 www.italvibrasusa.com

REV	DESCRIPTION	DATE	APPROVED

(40) HOLES EQ. SPACED ON A Ø147" BHC  
 (24) Ø1 1/8" HOLES  
 (16) 1-8NC TAPPED HOLES



CERTIFIED DRAWINGS  
 SERIAL NO 1115014  
 DATE 1/26/16

NOTES:

1. CONTACT MATERIAL: CARBON STEEL
2. VIBRATOR: 7HP, TENV, 230/460/3/60, CL.II/DIV.II, GROUP G
3. CONTACTS ARE PRIMED; EXTERIOR IS PRIME & PAINTED WITH BLUE ENAMEL
4. QTY. (3) REQUIRED

MATERIAL NAME	DRIED SLUDGE
BULK DENSITY	45 LBS./CU. FT.
PARTICLE SIZE DISTRIBUTION	1-10 MM
TEMPERATURE °F	PLEASE ADVISE
MOISTURE CONTENT %	8% MAX
PRESSURE	PLEASE ADVISE
DISCHARGE OR FEED RATE	40,000 LBS./HR.

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<b>Metafab, Inc.</b>		P.O. Box 9, Prices Switch Road, Vernon, NJ 07462 (973)-764-2000 Fax: (973)-764-0272 Web Site: www.metafabinc.com	
DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONS: ±1/16" ANGULAR: MACH ±1/2°, BEND ±1° THREE PLACE DECIMAL		NAME DRE 11/11/15	TITLE BA12-JAPH-S14MM FOR KOMLINE SANDERSON
MATERIAL FINISH		CHECKED END APP.	SIZE A
DO NOT SCALE DRAWING		COMMENTS	SCALE: 1:8 WEIGHT: SHEET 1 OF 1

**Komline-Sanderson**12 Holland Av  
908-234-1000Peapack, NJ 07977-0257  
Fax: 908-234-9487  
[www.komline.com](http://www.komline.com)

## OPERATION AND MAINTENANCE MANUAL

Title of Project: Lake County Public Works Department  
Des Plaines River WRF  
Phases 2B & 3 Improvements

Specification Number: 11650G Paragraph 2.4 F  
Specification Title: Detail Biosolids Thermal Drying System  
Solids Storage Outlet Valves  
Tags: FV-12-6-1, FV-12-9-1 & FV-12-12-12-1

Manufacturer: PEBCO

General Contractor: Williams Brothers Construction, Inc.

Subcontractor:

Supplier: Komline-Sanderson



225 North 4<sup>th</sup> Street  
P.O. Box 7506  
Paducah, KY 42001  
(270) 442-1996  
Fax (270) 442-5214

## *EQUIPMENT MANUAL*

### **MANUAL: INSTALLATION, START-UP, MAINTENANCE**

---

**THIS MANUAL PREPARED FOR:**  
**KOMLINE-SANDERSON**  
**BOX 257**  
**12 HOLLAND AVE**  
**PEAPACK, NJ 07977**

**PROJECT:**  
**LAKE COUNTY DES PLAINES RIVER**  
**WRF**  
**800 KRAUSE DRIVE**  
**BUFFALO GROVE, IL 60089**

**PURCHASE ORDER NUMBER:**  
**PO 85540**

**PEBCO®FILE #177214**  
**EQUIPMENT: RSX-14-PA-FLD-CS-A4-NB-M**  
**SOLIDS STORAGE OUTLET VALVES**  
**TAG #'S:**  
**FV-12-6-1**  
**FV-12-9-1**  
**FV-12-12-1**

**PERSONNEL SHOULD READ THIS MANUAL IN ITS ENTIRETY AND BECOME FAMILIAR WITH THE EQUIPMENT AND ITS COMPONENTS BEFORE ATTEMPTING OPERATION OR MAINTENANCE.**

O&M MANUAL SUBMITTAL CHECKLIST (Page 1 of 5)

PROJECT NAME Des Plaines River WRF

CONTRACT NO. K-S Job D0493

CONTRACTOR Komline-Sanderson

EQUIPMENT/SYSTEM Solids Storage Outlet Valves

SECTION NO. 11650H

MANUFACTURER/VENDOR PEBCO

FORMAT

Size: 8-1/2 x 11 or 11 x 17  
 Paper: 20-pound minimum  
 Text: Printed data/neatly typed  
 Drawings: Standard size bound in text; in text-size labeled envelopes

Tabbed Section Dividers

Cover Label: Title  
 Project Name  
 Building/Structure ID  
 Equipment Name  
 Specification Section

Binders: Plastic Cover

# O&M MANUAL SUBMITTAL CHECKLIST (Page 2 of 5)

## GENERAL CONTENTS

<u>Provided</u>	<u>Not Applicable</u>	<u>Page No.</u>	
	X		One Specification Only
X		1,2	Title Page:
X		1,2	Title
X		1	Project title
	X		Building/structure ID
X		1,2	Equipment name
X		1	Specification section number
X		1	Contractor ID
	X		Subcontractor ID
X		8	Purchase order data
X		2	Manufacturer ID
X		1,2	Service/parts supplier ID
X		Varies	Product List
	X		Table of Contents
	X		Tabbed Sections:
	X		Pertinent data sheets
	X		Annotated as needed
X		Varies	Text:
			Pertinent to project
	X		Annotated
X		11	Drawings:
X		Varies	Illustrate product and components
	X		Control and flow diagrams
	X		Special Information:
X		11	Interrelationships of equipment and components
X		Varies	Instructions and procedures
X		Varies	Instructions organized in
X		Varies	Instructions in logical
	X		Glossary
X		34	Warranty, Bond, Service Contract

O&M MANUAL SUBMITTAL CHECKLIST (Page 3 of 5)

MANUAL FOR MATERIALS AND FINISHES

<u>Provided</u>	<u>Not Applicable</u>	<u>Page No.</u>	
_____	<u>X</u>	_____	Building Products:
_____	<u>X</u>	_____	Product data
_____	<u>X</u>	_____	Catalog number
_____	<u>X</u>	_____	Size
_____	<u>X</u>	_____	Composition
_____	<u>X</u>	_____	Color and texture designations
_____	<u>X</u>	_____	Care and Maintenance Instructions
_____	<u>X</u>	_____	Recommended cleaning agents and methods
_____	<u>X</u>	_____	Cleaning precautions
_____	<u>X</u>	_____	Cleaning and maintenance schedule
_____	<u>X</u>	_____	Moisture Protection Products:
_____	<u>X</u>	_____	Product data listing
_____	<u>X</u>	_____	Chemical composition
_____	<u>X</u>	_____	Installation details
_____	<u>X</u>	_____	Inspection recommendations
_____	<u>X</u>	_____	Maintenance and repair
_____	<u>X</u>	_____	Additional Data as Required

O&M MANUAL SUBMITTAL CHECKLIST (Page 4 of 5)

MANUAL FOR EQUIPMENT AND SYSTEMS

<u>Provided</u>	<u>Not Applicable</u>	<u>Page No.</u>	
<u>X</u>	<u>      </u>	<u>      </u>	Description of Unit and Components:
<u>      </u>	<u>X</u>	<u>      </u>	Equipment functions
<u>      </u>	<u>X</u>	<u>      </u>	Normal operating characteristics
<u>      </u>	<u>X</u>	<u>      </u>	Limiting conditions
<u>      </u>	<u>X</u>	<u>      </u>	Performance curves
<u>      </u>	<u>X</u>	<u>      </u>	Engineering data
<u>X</u>	<u>X</u>	<u>      </u>	Test data
<u>X</u>	<u>      </u>	<u>44</u>	Replaceable parts list (with numbers)
<u>X</u>	<u>      </u>	<u>11</u>	P&ID numbers
<u>X</u>	<u>      </u>	<u>Varies</u>	Operating Procedures:
<u>      </u>	<u>X</u>	<u>      </u>	Startup
<u>      </u>	<u>X</u>	<u>      </u>	Break-in
<u>      </u>	<u>X</u>	<u>      </u>	Routine/normal operation
<u>      </u>	<u>X</u>	<u>      </u>	Regulation and control
<u>      </u>	<u>X</u>	<u>      </u>	Stopping and shutdown
<u>      </u>	<u>X</u>	<u>      </u>	Emergency
<u>      </u>	<u>X</u>	<u>      </u>	Seasonal operation
<u>      </u>	<u>X</u>	<u>      </u>	Special instructions
<u>X</u>	<u>      </u>	<u>23</u>	Maintenance Procedures:
<u>X</u>	<u>      </u>	<u>Varies</u>	Routine/normal instructions
<u>X</u>	<u>      </u>	<u>Varies</u>	Troubleshooting guide
<u>X</u>	<u>      </u>	<u>Varies</u>	Disassembly/reassembly/repair
<u>X</u>	<u>      </u>	<u>Varies</u>	Alignment/adjusting/balancing
<u>X</u>	<u>      </u>	<u>25</u>	Servicing and Lubrication:
<u>X</u>	<u>      </u>	<u>25</u>	List of lubricants
<u>X</u>	<u>      </u>	<u>24</u>	Lubrication schedule
<u>X</u>	<u>      </u>	<u>9,24</u>	Maintenance schedule
<u>X</u>	<u>      </u>	<u>Varies</u>	Safety Precautions/Features
<u>      </u>	<u>X</u>	<u>      </u>	Sequence of Operation of Controls
<u>X</u>	<u>      </u>	<u>11</u>	Assembly Drawings
<u>X</u>	<u>      </u>	<u>Varies</u>	Parts List and Illustrations:
<u>      </u>	<u>X</u>	<u>      </u>	Predicted life
<u>      </u>	<u>X</u>	<u>      </u>	Recommended spare parts list and prices
<u>      </u>	<u>X</u>	<u>      </u>	Control Diagrams/Schematics
<u>      </u>	<u>X</u>	<u>      </u>	Bill of Materials



O&M MANUAL SUBMITTAL CHECKLIST (Page 5 of 5)

<u>Provided</u>	<u>Not Applicable</u>	<u>Page No.</u>	
<u>X</u>	<u>      </u>	<u>8</u>	Completed Equipment Data Form per Specification
<u>      </u>	<u>X</u>	<u>      </u>	Valves
<u>      </u>	<u>X</u>	<u>      </u>	Catalog Cuts and Tag Numbers
<u>X</u>	<u>X</u>	<u>Varies</u>	Maintenance Instructions
<u>      </u>	<u>X</u>	<u>      </u>	Panelboard Directories:
<u>      </u>	<u>X</u>	<u>      </u>	Electrical
<u>      </u>	<u>X</u>	<u>      </u>	Controls
<u>      </u>	<u>X</u>	<u>      </u>	Communications
<u>      </u>	<u>X</u>	<u>      </u>	Instrumentation Loops:
<u>      </u>	<u>X</u>	<u>      </u>	Diagrams
<u>      </u>	<u>X</u>	<u>      </u>	Components list each circuit/loop
<u>      </u>	<u>X</u>	<u>      </u>	Additional Data As Required

EQUIPMENT DATA FORM (Page 1 of 3)

PROJECT NAME Des Plains River WRF

CONTRACT NO. K-S Job D0493

CONTRACTOR Komline-Sanderson

EQUIPMENT NO. FV-12-6-1, FV-12-9-1, FV-12-12-1

DESCRIPTION Solids Storage Outlet Valves

LOCATION 800 Krause Drive, Buffalo Grove, IL 60089

MANUFACTURER PEBCO

PURCHASED FROM PEBCO PURCHASE DATE 11/09/2015

VENDOR ORDER NO. \_\_\_\_\_ PURCHASE PRICE \$5,941 each

LOCAL SUPPLIER \_\_\_\_\_ PHONE 270-442-1996

ADDRESS \_\_\_\_\_

MODEL NO. RSX-14-PA-FLD-CS-A4-NB-M SHIPPING WT/UNIT 425 lbs. each

NO. OF UNITS 3 SERIAL NOS. 22389

NAMEPLATE DATA

<u>ELECTRIC MOTOR</u>	<u>PUMP/HVAC UNIT</u>	<u>DRIVE/REDUCER</u>	<u>OTHER (I&amp;C)</u>
MANUFACTURER:	MANUFACTURER:	MANUFACTURER:	MANUFACTURER:
<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>Honeywell</u>
TYPE: <input type="checkbox"/> AC <input type="checkbox"/> DC	TYPE _____	TYPE: <input type="checkbox"/> GEAR <input type="checkbox"/> V-BELT <input type="checkbox"/> CHAIN <input type="checkbox"/> VARIDRIVE	TYPE <u>Limit Sw</u>
HP _____	SIZE _____		SIZE _____
RPM _____	CAPACITY _____		CAPACITY _____
VOLTAGE _____	PRESSURE _____	SERVICE FACTOR _____	RANGE _____
AMPERAGE _____	ROTATION _____	RATIO _____	
PHASE _____	IMPELLER: SIZE _____		
FRAME _____	MATERIAL _____		

EQUIPMENT DATA FORM (Page 2 of 3)

MAINTENANCE SUMMARY

EQUIPMENT NO. FV-12-6-1, FV-12-9-1, FV-12-12-1

DESCRIPTION Solids Storage Outlet Valves

MAINTENANCE OPERATION

List briefly each maintenance operation required and refer to specific information in Manufacturer's Maintenance Manual, if applicable. Refer by symbol to "Lubricant List" for Lubrication Operation.

Check System Pressure

Drain Air Receiver (Manual Units Only)

Check Lubricator

Clean/Replace FRL Trio Filter

Check Drain (Automatic Units Only)

Check Cylinder Clevis Pins

Check for Dust Leakage

Lubricate Flange Bearings

Check/Clean Muffler

Check for Frayed/Exposed Wiring

Inspect Mounting Bolts

Check Air Circuitry for Leakage

See also Section 4 of PEBCO O&M Manual

FREQUENCY

List required frequency of each maintenance operation.

Weekly

Weekly

Weekly

Monthly

Monthly

Monthly

Monthly

Monthly

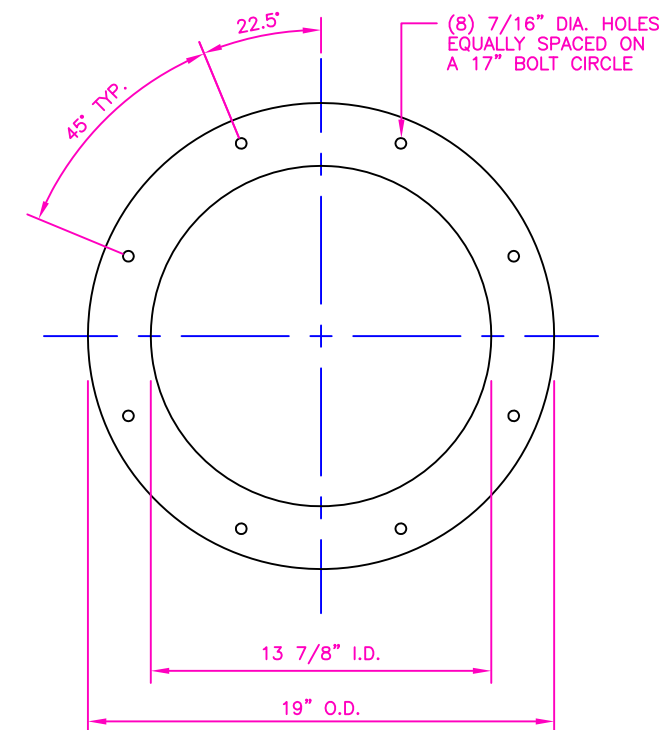
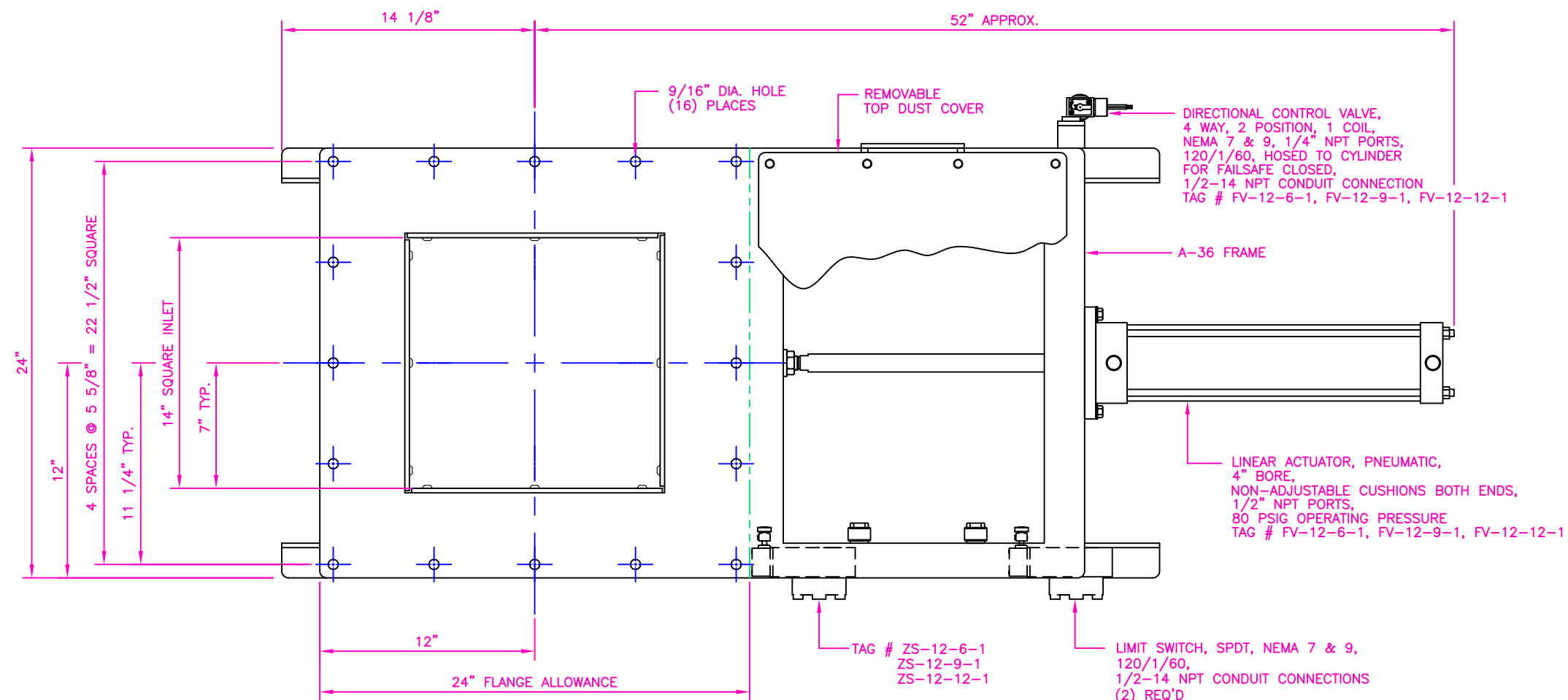
Quarterly

Yearly

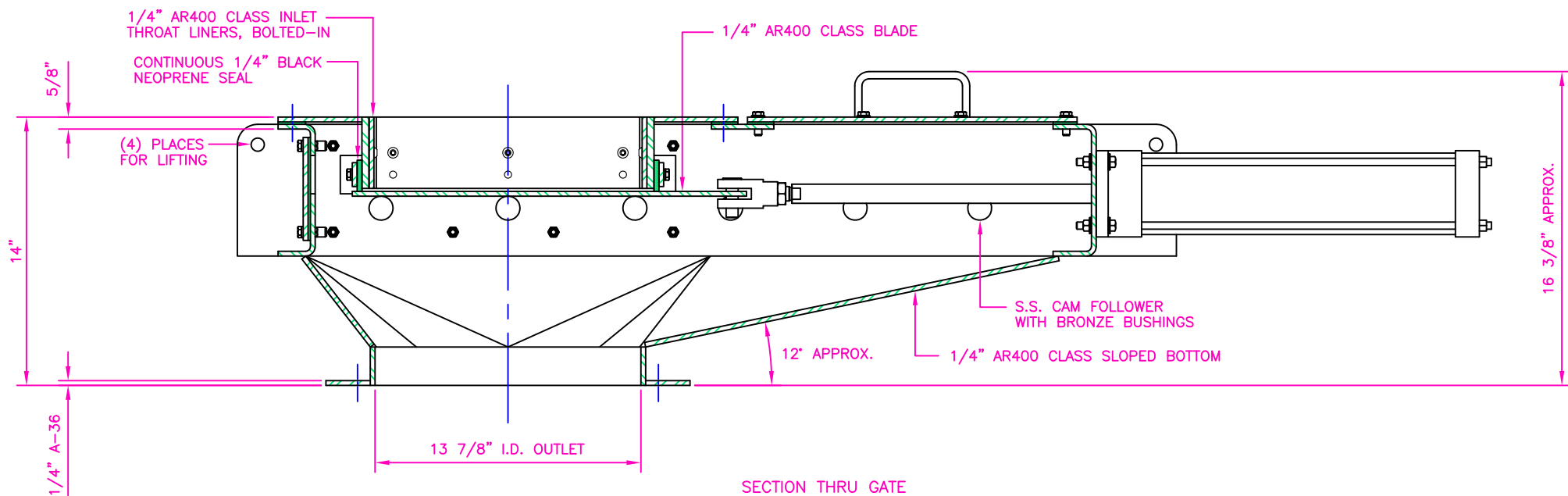
Yearly


Yearly





CUSTOMER : KOMLINE-SANDERSON  
CUSTOMER P.O. No. : 85542  
PEBCO JOB No. : 177214  
PEBCO SERIAL No. : 22389  
PRODUCT : DRIED BIOSOLIDS  
DENSITY : 45-55 PCF  
SIZE : 1-10mm  
TEMP. : 120°F  
FLOW RATE : 20 STPH  
INTERNAL PRESSURE : ATMOSPHERIC  
FINISH :  
PER SECTION 09900 SYSTEM 6 OF CUSTOMERS SPECIFICATION :  
CLEAN PER SSPC-SP6  
1st COAT - COROTECH WATERBORNE BONDING PRIMER V175, 1.5 to 2.1 mil DFT  
2nd COAT - COROTECH V400 POLYAMIDE HIGH BUILD EPOXY, 4 to 5.2 mil DFT  
3rd COAT - COROTECH V515 ALIPHATIC ACRYLIC URETHANE, RAL 6018, 2 to 2.2 mil DFT  
TOTAL DFT : 7.5 to 9.5 mil  
APPROX. WEIGHT : 425 LBS. PER GATE  
QTY. : (3)  
EQUIPMENT TAG NoS : FV-12-6-1, FV-12-9-1, FV-12-12-1



						THIS DRAWING IN DESIGN AND DETAIL IS THE PROPERTY OF PEBCO, AND MUST BE USED ONLY IN CONNECTION WITH OUR WORK. ALL RIGHTS OF DESIGN OR INVENTION ARE RESERVED			 <b>PEBCO®</b> P.O. BOX 7506 PADUCAH, KY. 42002-7506 (270) 442-1996 FAX (270) 442-5214 www.pebco.com	14" ROLLING SLIDE GATE			
C	ADDED TAG #S TO VALVE, CYLINDER AND LIMIT SWITCHES. ISSUED CERTIFIED	TF-DAV	3.2.2016	JDB	3.4.2016	<div>CERTIFIED</div>	DRAWN: JRW			11.12.2015	EXTERNALLY ADJUSTABLE SEALS		
B	ADDED ADDITIONAL FINISH INFORMATION	JRW	1.21.2016	CM	1.21.2016		CHECKED: CM			11.16.2015	PNEUMATIC OPERATION		
A	CHANGED PRODUCT SIZE, PRODUCT TEMPERATURE & FINISH	JRW	12.3.2015	CM	12.3.2015		RELEASED: JRW			3.4.2016	MODEL #RSX-14-PA-FLD-CS-A4-NB-M		
REV.	DESCRIPTION	BY	DATE	CHECKED BY	DATE		SCALE 1/4 (D)			JOB No. 177214	DRAWING NO. 22389		
										SHEET 1	REV C		



## SLIDE GATE MANUAL

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# 1 MANUAL OVERVIEW

---

## 1.0 MANUAL CONTENTS

This Section of the manual will familiarize you with the contents of the other manual sections. This manual is general in approach and may not include everything you want to know about the specifics of your particular application. Specific technical information can be found on the drawings which are a part of this manual.

If you have any questions, which cannot be answered by the written material provided, call **PEBCO®** (270) 442-1996 or FAX (270) 442-5214.

## 2.0 STORAGE RECOMMENDATIONS

**Section 2** covers recommendations for proper storage. In some cases, scheduling requirements or construction delays result in the equipment being stored prior to installation. The guidelines suggested in this section are to aid the installer in selection of proper storage conditions. Because of variability in site conditions/facilities, proper equipment storage/protection is the responsibility of the purchaser or his agent.

**PEBCO®** is not responsible for any equipment damage which results from inadequate storage/protection efforts.

## 3.0 GENERAL INSTALLATION

**Section 3** covers installation and start-up procedures. Pay special attention to the **!!! WARNING !!!** in **Section 3.2**. Generally gates which are other than manually operated, will “failsafe” close if power to the directional valve controlling the gate is interrupted. Material is included on installation of manually or pneumatically operated gates. Carefully consider the information dealing with the installation of manual operators. Extreme care and good safety procedures should be used whenever working at height or around moving equipment.

## 4.0 MAINTENANCE RECOMMENDATIONS

**Section 4** covers recommendations for maintenance procedures. Material is presented on gate lubrication, pneumatic system maintenance, gate seal adjustment or replacement and pneumatic system troubleshooting.

## 5.0 WARRANTY

**Section 5** is **PEBCO®**'s Warranty to the purchaser of a Slide Gate.

## 2 STORAGE RECOMMENDATIONS

---

### 2.1 GENERAL REQUIREMENTS

If **PEBCO®** equipment is to be stored for a period of time longer than three weeks prior to installation, the following procedures are recommended:

- Equipment should be stored in enclosed areas. Indoor storage area should be clean and dry. Storage should be off of the floor, preferably on skids or pallets.
- Storage area should be free from rapid temperature changes. If necessary, an additional heat source should be used.
- Storage area should not subject equipment to vibration.
- All interior and exterior surfaces of the spout must be thoroughly coated with Cosmoline. Any unpainted surfaces, such as shafts, rollers, bearings, and pins should be given special attention to ensure a thorough covering of Cosmoline.
- Storage must be above any possible water or snow line.
- All bearings must be fully charged with grease.
- Periodic inspections should be made, checking the covering, any moisture present, cleanliness and general appearance to ensure the absence of corrosion and the integrity of the Cosmoline coating.
- If outdoor storage is necessary, the equipment should be fully covered with weather-proof material, vented so as not to trap moisture, but drip-proof so the water cannot enter or splash up into it.

### 2.2 ELECTRICAL EQUIPMENT

- All electrical device enclosures must be opened and coated with CRC Stor & Lube.
- All electrical connections (terminations) must be coated with CRC Stor & Lube.
- All electrical openings must be capped or plugged as necessary to be sealed to atmosphere.
- Electrical junction boxes included with the equipment should be opened and any exposed wire and terminations should be coated with CRC Stor & Lube. Open conduit connections should be plugged or capped to atmosphere and the enclosure door should be securely tightened to ensure sealing integrity.

## 2.3 ACTUATORS

### 2.3.1 Hydraulic and Pneumatic Linear Actuators

- Hydraulic and pneumatic cylinders must be filled with 10 wt. oil. Assurances must be taken to assure complete filling of the cylinders with oil. As an alternate, the hydraulic cylinders may be filled with the same fluid the hydraulic system will operate with.
- The hydraulic or pneumatic cylinder rod must be fully retracted within the cylinder body.
- The hydraulic or pneumatic cylinder must be removed and stored in a vertical orientation with the rod end up. All external surfaces of the cylinder, along with clevises and pins, must be thoroughly coated with Cosmoline.
- A relief valve shall be installed in the cylinder ports to allow for fluid expansion as the result of increases in ambient temperatures.
- Pneumatic Direction Valves should be filled with Parker F442002 lubricating fluid. After filling, a small amount should be drained out and the ports should be plugged. This includes removal of the mufflers and plugging to assure sealing from atmosphere.

### 2.3.2 Electric Actuators

- The actuator rod must be fully retracted within the actuator body.
- The electrical enclosure must be opened and coated with CRC Store and Lube.
- All conduit opening must be plugged or capped as required to seal to atmosphere.
- All external surfaces of the actuator shall be coated with Cosmoline. Special attention should be paid to assure coating of pins, clevises and any unpainted surfaces.

## 2.4 ADDITIONAL REQUIREMENTS

**Prior to long-term storage, and start-up after storage, please refer to any and all applicable instructions published by individual component manufacturers.**

## 3 GENERAL INSTALLATION

---

### 3.1 RECEIVING INSPECTION

Upon receipt of the equipment, a thorough inspection of the equipment should be made. The following points should be noted:

- Condition of the shipping crate/skid that would indicate rough handling or possible equipment damage
- Condition of the equipment itself; obvious dents, bent flanges, loose or broken accessories, oil leaks, etc. Dents in the housing can cause the blade(s) to bind or jam. Bent flanges will defeat the sealing capability of the gate.
- If the equipment is supplied with an actuating system (pneumatic, electrical, or hydraulic), inspect the hosing/tubing for punctures, uncapped or disconnected lines. Insure that all parts are included.
- Check packing list to see if any parts were shipped loose, and if they are packed with the equipment

REPORT ANY DAMAGE OR MISSING COMPONENTS TO THE DELIVERING CARRIER.

### 3.2 INSTALLATION WARNING

#### !!! WARNING !!!

It is important to remember that the installation of a pneumatically or hydraulically operated gate should be done with the air and/or fluid lines completely shut off to the directional valve operating the gate. Should the installation or inspection work during installation be carried out on an open gate, and an electrical power failure occurs, the gate blade will automatically go to its closed position.

It is imperative to remember that AUTOMATIC CLOSING will occur and that the directional valve(s) must be isolated. It is also important to remember that any air and/or fluid trapped between the directional valve(s) and the cylinder(s) should be released to atmosphere or returned to tank whichever the case may be.

IT IS RECOMMENDED THAT A MANUAL ISOLATION VALVE BE INSTALLED IN THE SUPPLY AIR OR HYDRAULIC LINE IMMEDIATELY BEFORE THE GATE, FOR MAINTENANCE PURPOSES.

### 3.3 GATE MOUNTING

PEBCO® Bulk Material Handling Gates are generally designed with flange type mounting at the inlet and outlet openings. This facilitates easy and simple installation on a wide range of material storage and transfer systems. The following steps will aid the installer in completing the installation.

1. Straighten any bends in the top and bottom flanges. Also, straighten the flanges on which the gate is to be mounted. Remove any old sealing material or materials that would prevent a flush contact between new and old flanges.

2. Check the alignment of the bolt holes to determine if the bolt holes will match correctly. Do not attempt to correct alignment by drilling through the gate flange as this will possibly weaken the flange and result in a poor seal.
3. Attach the gasket material or sealing compound. Use a sealant that is compatible with the particular system and material requirements.
4. Position the gate relative to the adjoining flanges. Depending on the size of the gate and the position in which the gate is to be installed, this may be done manually, or it may require that the gate be hoisted mechanically. Practice safe lifting when installing the gate, or removing the gate for maintenance purposes. When rigging the gate to be lifted mechanically, attach rigging to the lifting lugs provided on the gate. Avoid lifting from any nonstructural components of the gate. This includes, but is not limited to, hydraulic or pneumatic cylinders, electrical components, and cover handles. Attempting to lift from nonstructural components may result in damage, injury, or death.
5. Install the mounting bolts. Use only a high grade hex head bolt with an equal grade of nut, flat and lock washer. A thread locking compound is suggested if vibration is present.

**NOTE:** Bevel washers are recommended on flanges in structural channels.

**It is required that flanges mating to PEBCO® equipment are flat, true, and square. This will avoid induced distortion of the GATE/VALVE.**

### 3.3.1 Manually Operated Gates and Valves

If the gate is equipped with a manual operator such as a lever, “T”-handle, ratchet handle, handwheel or chainwheel, the operator may have been shipped loose because of size or to reduce the possibility of shipping damage.

Proper field installation of the operating device is very important.

PEBCO®’s general attachment designs are discussed in the following paragraphs. It is possible that more than one retention method may be employed for a particular application. No attempt is made to describe attachment combinations.

See the relevant PEBCO® Mechanical Drawing for your particular job to determine specific operator installation requirements. If you have any questions regarding manual operator attachment, call PEBCO®’s Production Manager at (270) 442-1996 or fax (270) 442-5214.

Regardless of which operator attaching method is used, check for pinch points or interference between the manual operator and the gate frame or body or nearby structures. If an obvious problem exists do not operate the gate until it is corrected. During the very first cycling of the gate, carefully observe gate operation and watch for interference or other problems.

#### SET SCREW RETAINED MANUAL OPERATORS

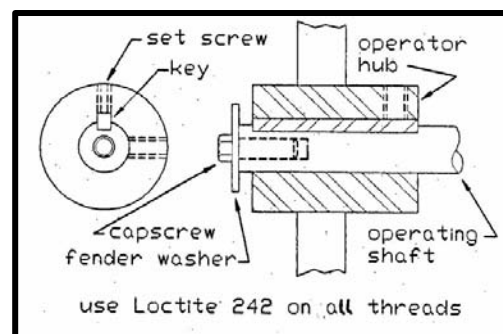
In light duty applications, one or more set screws may be all that is required to transmit torque and secure the operator to the shaft. When screwed in, the set screw may rest on the

“normal” shaft surface or occupy some type of “hole” (slot, groove, dimple, hole, etc.) in the gate operating shaft. If a “hole” is provided in the gate operating shaft, make sure the set screw and “hole” mate when the parts are assembled.

**NOTE:** Loctite 242 is to be applied to every threaded fastener used in operator installation. This applies to not only the set screws being discussed in this paragraph, but to any threaded fastener used in all operator installations. Follow all Loctite instructions regarding cleaning/priming and cure times.

### KEYED MANUAL OPERATORS

A keyed attachment design uses a key-way in both the operator and the gate operating shaft. A key (rectangular block of metal) is usually squarely placed in the key-way on the operating shaft. The key-way in the operator is aligned with the key in the operating shaft and the operator is slid over the key. Generally two set screws are used with keyed operators. One set screw hole is in line with the key. The other set screw hole is usually 90° from the first. The set screws are turned in against the key/shaft and prevent the operator from sliding longitudinally on the gate operating shaft.



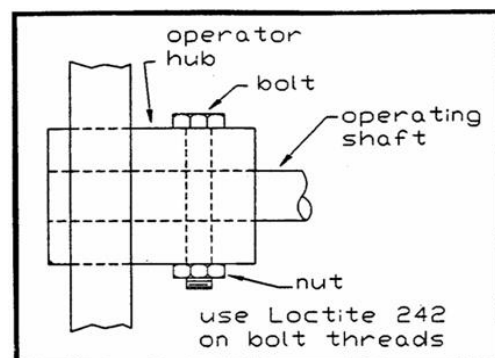
**Figure 1: Keyed Manual Operator**

In addition to the set screws, when possible, a large fender washer is bolted to the end of the gate operating shaft. This washer prevents the operator from sliding off of the shaft should the set screws loosen (See **Figure 1**).

**DO NOT FORGET THE LOCTITE 242 ON BOTH THE SET SCREW THREADS AND THE WASHER RETAINING BOLT THREADS.**

### THRU-BOLTED MANUAL OPERATORS

The thru-bolted design (**Figure 2**) is simple and effective at both transmitting torque and retaining the operator to the gate operating shaft. A hole is drilled thru both the operator and the gate operating shaft. The holes are aligned and a bolt is inserted thru the opening. A nut on the end of the bolt prevents the bolt from sliding from the hole.



**Figure 2: Thru-bolted Manual Operator**

### THRU-PINNED MANUAL OPERATORS

The thru-pinned design is like the thru-bolted design. A pin (generally a spring pin) is used instead of a bolt. An interference fit holds the pin in place.

### TAPERED LOCKING BUSHING MANUAL OPERATORS

Another attachment design is a locking bushing. A hub attached to the operator contains an integral key and tapered bushing. This assembly is slipped onto the gate operating shaft.

Depending on shaft size, two or more screws are turned into the hub. The screws wedge the bushing inward and securely lock it to the gate operating shaft.

### BONDED MANUAL OPERATORS

The final design is bonding. The operator is permanently attached to the gate operating shaft with a high strength bonding compound. When this design is used, **PEBCO®** specifies LOCTITE 680.

### 3.3.2 Pneumatically Operated Gates and Valves

1. If the gate is equipped with pneumatic actuators, air pressure should be connected to the directional control valves. Most pneumatic actuation systems supplied by **PEBCO®** are piped at the factory and require only checking of the connections for tightness. Only one connection is required to the directional valve. An FRL Trio should be installed in the air pressure source line if air is not conditioned and contains moisture and contaminants. Air pressure should not exceed 100 psig.

**NOTE:** A manual isolation valve should be installed just before the FRL Trio.

2. If the gate is not supplied with directional valves mounted, the installer should mount the valves as close as possible to the gate.
3. Hook electrical power to the directional valves and limit switches.

**NOTE:** On totally enclosed slide gates, a conduit hole will have to be drilled in the housing to accommodate a flexible conduit entry to the limit switches. Insure that the conduit will not interfere with the blade movement.

4. When piping and electrical connections have been made, apply air pressure and electrical power.
5. On directional control valves provided by **PEBCO®**, muffler speed controls are installed on the exhaust port(s) of the valve. Refer to Maintenance **Section 4.14**.
6. Cylinder cushions are adjusted at the factory, but a check should be made before operation. Refer to Maintenance **Section 4.8**.
7. During final checkout of the system, the muffler speed control(s) should be adjusted. To adjust the muffler speed control, loosen the retainer nut on the adjustment screw. Turn the adjustment screw all the way in until it seats and then back it out approximately 3 turns. Select either open or closed. When the cylinder starts to operate, adjust the adjustment screw until the desired speed is obtained. Tighten the retainer nut. On some systems, this procedure may have to be repeated for both the open and closed function.
8. Standard air cylinder cycling calls for either full open or full closed operation. This, normally, is accomplished through the use of a 4-way, 2-position, single solenoid directional control valve. One coil controls the spool inside the control valve body and, therefore, the direction of air flow. When the coil is momentarily energized, air flow is diverted to the rod end cylinder port, causing the cylinder rod to retract. When the coil is

de-energized, air flow is diverted to the cap end cylinder port, causing the cylinder rod to extend and air in the opposing port is exhausted to atmosphere.

9. It is always best to operate a gate on the lowest possible air pressure while still maintaining proper sealing, sufficient gate speed, etc. The exact pressure can best be established as a result of preliminary trial operation under normal operational conditions. Gates that are equipped with double acting air cylinders should be operated on 80 to 100 psi of lubricated and filtered air. Every application is different and generally requires its optimal regulated air pressure. The time spent determining the minimum operational pressure will pay off in maximum gate service life.

### 3.3.3 Hydraulically Operated Gates and Valves

1. If the gate/valve is equipped with hydraulic actuators, these will normally be shipped without connection to the solenoid valve.
2. If **PEBCO®** has supplied a hydraulic power unit with this order; refer to the installation and start-up procedure described in the hydraulic system manual.
3. If an existing power unit is to be utilized, make the hydraulic connection from the solenoid valve to the hydraulic actuator on the gate/valve.
4. If the gate is not supplied with directional valve mounted, the installer should mount the valves as close as possible to the gate/valve.

### 3.3.4 Electrically Operated Gates and Valves

1. If the gate/valve is equipped with an electric drive (rotary or linear), refer to the manufacturers data in the associated cut sheet.
2. If the actuator is shipped mounted to the gate/valve, the internal limit switches have been preset. HOWEVER, as a precaution, these should be checked prior to applying power to the electric actuator. Refer to manufacturers' procedure in the associated cut sheet.



## 4 MAINTENANCE RECOMMENDATIONS

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### 4.1 MAINTENANCE PROGRAM IMPORTANCE

An inspection and maintenance program should be established to ensure the successful operation of the equipment during its working life.

One of the most important aspects of any maintenance program lies in establishing a good set of operating records. Daily log sheets should be set up to record all important operating parameters of the equipment. Inspection at predetermined intervals is essential. The frequency of inspections may vary with operating conditions and the environment of operation. Complete records will also indicate spare parts used and on-hand, and the historical details of any maintenance or overhaul which takes place.

The purpose of a good maintenance program is to achieve maximum operating performance while holding down maintenance costs.

### 4.2 WEAR PARTS

Parts exposed to high frictional forces, whether due to the sliding of two parts against each other, or due to exposure to the product flow, are expected to wear and may need to be replaced. **PEBCO®** does not consider the wearing of Seals, Retainers, Liners, or Blades due to friction to be a defect as covered under the product warranty, and replacement of said parts is considered to be the responsibility of the purchaser.

### 4.3 MAINTENANCE SCHEDULE

Scheduled inspection of equipment and active preventive maintenance are essential for optimum performance and long equipment life. This section lists suggested schedules for maintenance. However, actual service conditions and environment greatly affect equipment reliability and such schedules should be adjusted as necessary to suit the specific requirements of the installation.

During normal operation, small portions of process material may collect at the end port of the gate, opposite the actuator end. This port should be routinely checked for blockage. Any blockage found can be removed with high pressure air or a stiff brush (be careful not to scar the paint surrounding the port).

### 4.3.1 Suggested Maintenance Schedule

	Weekly	Monthly	Quarterly	Yearly
All Systems		Check for Dust Leakage <input type="checkbox"/>		Check for Frayed/ Exposed Wiring <input type="checkbox"/>
		Lubricate Flange Bearings <input type="checkbox"/>		Inspect Mounting Bolts <input type="checkbox"/>
Pneumatic Systems	Check System Pressure <input type="checkbox"/>	Clean/Replace FRL Trio Filter <input type="checkbox"/>	Check/Clean Muffler <input type="checkbox"/>	Check Air Circuitry for Leakage <input type="checkbox"/>
	Drain Air Receiver (Manual Units Only) <input type="checkbox"/>	Check Drain (Automatic Units Only) <input type="checkbox"/>		
	Check Lubricator <input type="checkbox"/>	Check Cylinder Clevis Pins <input type="checkbox"/>		
Hydraulic Systems	Check System Pressure <input type="checkbox"/>	Check Cylinder Clevis Pins <input type="checkbox"/>	Tool Check for Loose Hardware <input type="checkbox"/>	
	Visually Check for Loose Hardware <input type="checkbox"/>			

### 4.3.1 Spare Part Installation Log

Date	Part	Qty.	Comments

## 4.4 SAFETY PRECAUTIONS

Basic common sense and extraordinary safety precautions should be followed at all times.

### !!! WARNING !!!

It is important to remember that the installation of a pneumatically operated gate should be done with the air lines completely shut off to the directional valve operating the gate. Should the installation or inspection work during installation be carried out on an open gate, and an electrical power failure occurs, the gate blade will automatically go to its closed position.

It is imperative to remember that AUTOMATIC CLOSING will occur and that the directional valve(s) must be isolated. It is also important to remember that any air and/or fluid trapped between the directional valve(s) and the cylinder(s) should be released to atmosphere or returned to tank whichever the case may be.

IT IS RECOMMENDED THAT A MANUAL ISOLATION VALVE BE INSTALLED IN THE SUPPLY AIR LINE IMMEDIATELY BEFORE THE GATE, FOR MAINTENANCE PURPOSES.

## 4.5 LUBRICATION

General recommendation is for lubrication every 100 hours of operation using NLGI #2 Lithium based grease.

### 4.5.1 Cam Followers

Grease fittings on cam followers (gate rollers) can be accessed from the outside of the unit. Some special stainless steel cam followers do not require lubrication and hence have no grease fittings.

### 4.5.2 Flange Bearings

The lubrication of flange bearings is necessary only if the bearing has a grease fitting installed. Most bearings utilized are bushing type of a bronze material, and require only light oiling. Upon installation of the gate/valve, lubrication is not necessary. All lubrication points are lubricated at the factory.

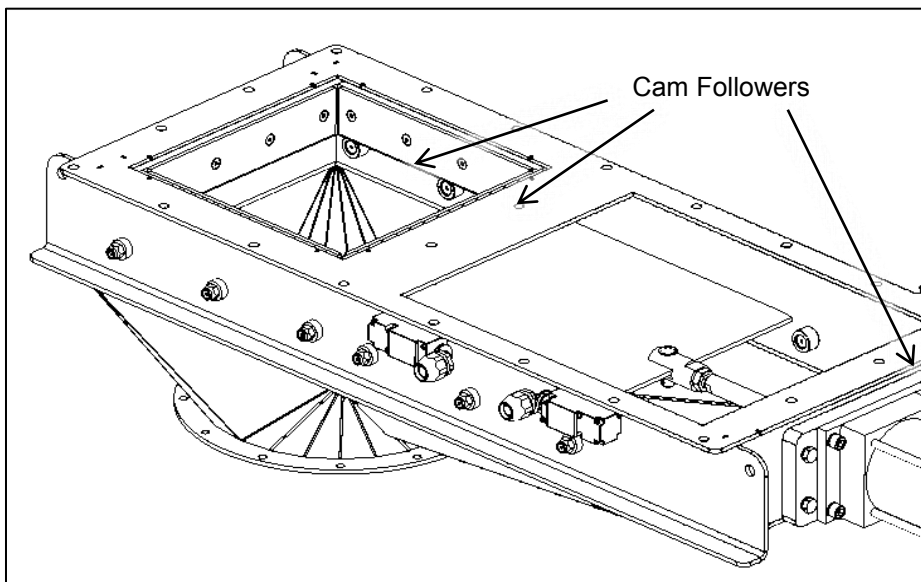
### 4.5.3 Gear Boxes

Refer to manufacturer's recommendations listed on specific component data sheet(s) for gear boxes (reducers, etc.).

### 4.5.4 Rod End Bearings

If the rod end has zerk grease it should be serviced at this time.

## 4.6 CAM FOLLOWER INSPECTION



**Figure 3:** Cam Follower Access

Check to insure that the rollers turn freely; and when the roller is turned, that no inward or outward movement in the roller occurs. If this occurs, the cam follower should be replaced. To access cam followers (**Figure 3**), the gate should be removed from its operational position and placed in an area that allows for easy access to the cam followers (Refer to **Section 3.3** for mounting), or the equipment above the gate should be removed to allow access to the cam followers. Cam followers in RSX models may be accessed without disconnecting the unit from other equipment; instead, the cam followers may be accessed by removing the top cover and access covers located on the body of the gate, as seen in **Figure 5**.

## 4.7 FRL TRIO INSPECTION/MAINTENANCE

1. Air pressure to the pneumatic circuit, 80 to 100 psi should be the normal operating range. Adjust the pressure regulator if necessary.
2. Check filter element - clean or replace the element every month - or when abnormal contaminant buildup is evident.
3. Check lubricator daily to insure that lubrication is always present to the pneumatic parts.
4. Drain the air receiver of water daily. If automatic drain is used, disregard this step.
5. Check air circuitry for leakage annually.
6. Filter, regulator and lubricator (FRL Trio) maintenance is as follows:
  - The filter assembly will have either an automatic or manual drain. If the filter is equipped with an automatic drain, the filter will automatically purge itself of fluids and contaminants on a periodic basis. This drain should be checked periodically because the automatic

drains do fail occasionally. If the filter is equipped with a manual drain, the drain should be purged on a regular basis. The filter also requires changing or cleaning of the filter element. The type of filter media varies from one manufacturer to another; most are of the serviceable type and require only cleaning and oiling. If the filter becomes clogged, there will be a pressure reduction to the air circuit and will result in slower gate movement.

- The regulator assembly requires no maintenance other than periodic checks of the system pressure. Air pressure should range from 80 to 100 psig.
- The lubricator is used to inject lubricating oil into the air line. The injection of lubrication occurs only during the time when air is drawn into the cylinders. This lubrication is used to insure free operation of directional valves and cylinders. This assembly should be checked frequently in heavy use to insure that lubrication is present at all times to the air circuit. Removal of the lubricator bowl is usually necessary to refill the assembly. It is suggested that for cold weather operation, this being below freezing, the additive KILL-FROST be used in the lubricator in place of the regular lubrication petroleum based fluid. This particular product will prevent freeze-ups of the valve and cylinder as well as providing the necessary lubrication to the components.

KILL-FROST can be used year round; however, the expense is usually prohibitive.

## 4.8 CYLINDER CUSHION ADJUSTMENT

Most pneumatic cylinders supplied with **PEBCO®** gates have cushions in each cylinder head. The cushion adjustment is by means of an allen head set screw. Turning this set screw “in” increases the cushion effect at the end of travel of the cylinder. Turning this set screw out reduces the cushion effect. The optimum setting is made at the factory by adjusting the set screw to be flush with the face of the cylinder head, and this setting should not have to be adjusted in cases of disassembly for maintenance.

## 4.9 CYLINDER REPLACEMENT

The following steps are required to remove the cylinder:

1. Close the gate and remove it from the installed operating location, disconnecting ALL pressure lines from the cylinder valve body.
2. Remove the top and bottom cover plates. The cylinder rod and blade clevis should be in view.
3. With the proper size wrench, loosen the clevis from the rod end using the wrench flats factory cut into the rod. Be careful not to damage the blade by over-torquing the rod end. It may be necessary to securely hold the clevis while turning the rod. Completely remove the rod end from the clevis.
4. Remove the cylinder mount bolts and carefully extract the cylinder from the remaining gate components.

To install the new cylinder, simply follow steps 1 through 4 in reverse order.

## 4.10 SEALS

### !!! WARNING !!!

No seals on **PEBCO®** Slide Gates are designed to be removed or adjusted during operation of the gate. The appropriate Lock-Out Tag-Out procedure should be followed before performing any maintenance on the unit to ensure that the gate is isolated from all electrical, hydraulic, and pneumatic systems. Likewise, all necessary steps should be taken to prevent any material from entering the gate during maintenance or inspection.

### 4.10.1 Gate Seal Adjustment

Adjustment of dust seals should be performed when signs of abnormal leakage and dust concentrations are evident. To adjust the seals, the bolts on the retainers are loosened, and the seal material pushed until light contact is made with the gate/valve blade. When this has been done, reapply Loctite 243 (for stainless steel applications use Loctite 567) to the retainer bolts, tighten the retainer bolts, and the adjustment is completed.

**CAUTION:** Do not push the seal material too tightly against the blade, as this will result in premature seal wear and blade binding.

### 4.10.2 Gate Seal Replacement

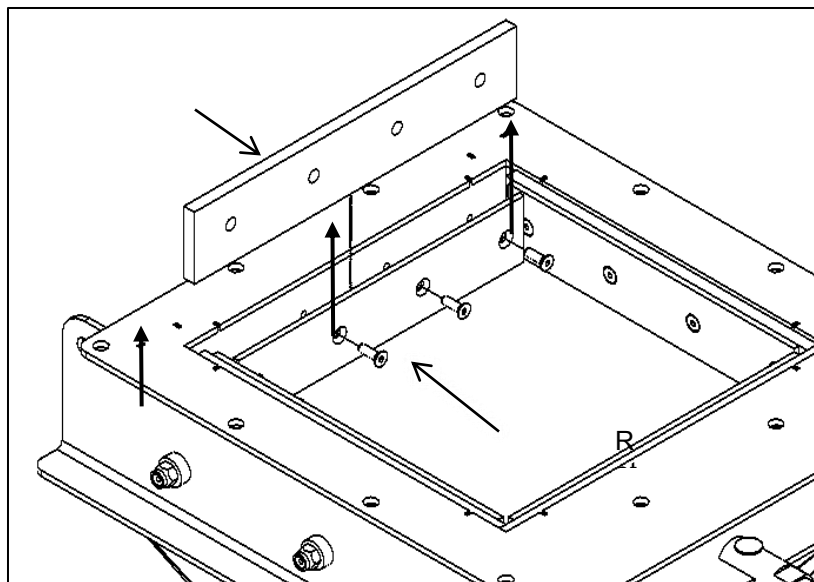
In some cases, replacement gate seals are furnished from the factory as blank sections of seal material slightly larger than the item they are to replace. This is necessary so that field fit up can be made to provide the optimum seal arrangement. In most cases, however, replacement seals are provided precut and ready for installation.

Gate seal replacement is basically the same procedure as adjustment with the only difference being that the retainer strips and bolts will have to be removed. The new set of gate seals and bolts should then be installed.

Holes may have to be punched in the new seals to accommodate the retainer bolts. This can be easily done by laying the retainer strip on the new seal and marking the location on the bolt holes. A slight elongation of the bolt holes in the seals should be considered to accommodate adjustment in the future.

### 4.10.3 Accessing Gate Seals and Retainers

For units with seal retainers positioned inside the flow area (see **Figure 4**), the gate should be removed from its operational position and placed in an area that allows for easy access to the seal retainers (Refer to **Section 3.3** for mounting), or the equipment above the gate should be removed to allow access to the seals and retainers.

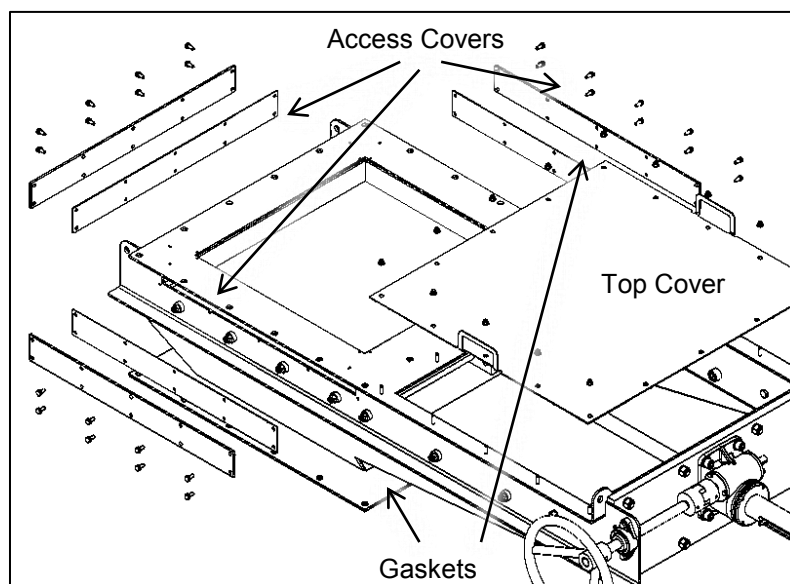


**Figure 4:** Retainer and seal removal for seal replacement.

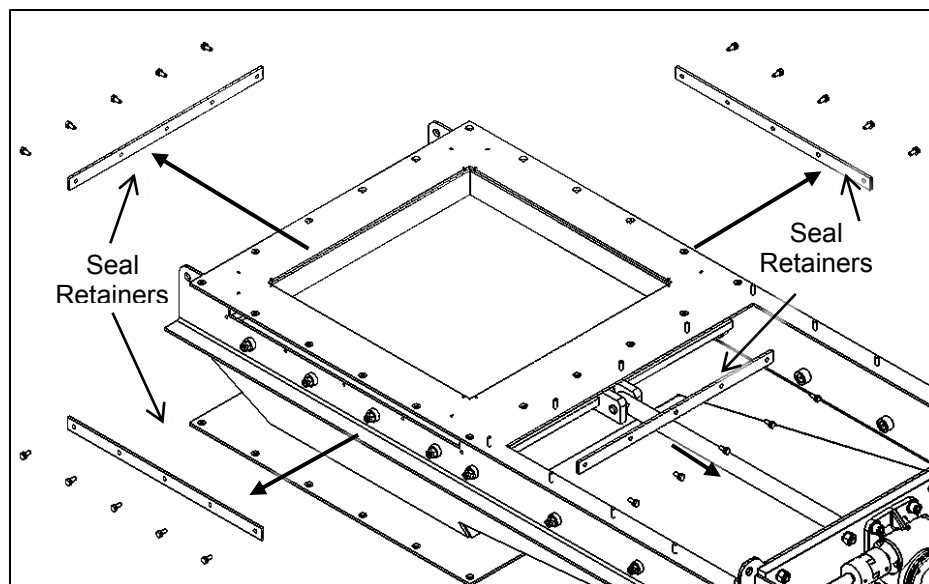
#### 4.10.4 Accessing Gate Seals and Retainers for RSX Models

Units with retainers outside the flow area allow for seals to be adjusted or replaced without disconnecting the unit from other equipment; instead, the seals may be accessed by removing the top cover and access covers located on the body of the gate, as seen in **Figure 5**.

Once the covers have been removed, the retainers can be accessed as shown in **Figure 6**. Depending on the model, there may be multiple seals, or a single continuous seal which wraps around the inlet plate. Remember to apply Loctite 243 (567 for stainless steel applications) to all threaded fasteners during reassembly.



**Figure 5:** Access Cover / Top Cover Removal (RSX Models)



**Figure 6:** Retainer Removal for Seal Adjustment and Replacement (RSX Models)

## 4.11 SLIDE GATE PACKING

### 4.11.1 Gate Packing Adjustment

Gate blade packing is intended to form a seal against leakage of dust to the environment. Properly adjusted, it is an effective barrier to fugitive dust. The packing gland follower typically has eight or more adjustment bolts, and the bolts must be tightened evenly to ensure an effective seal. The packing is factory installed and adjusted to only minimal compression. Should adjustment be necessary, tighten the adjustment bolts sequentially, in equal amounts, until either the dusting problem is stopped or the volumetric compression reaches 30%. Adjustment past this point may result in blade binding, and could indicate system or equipment problems which should be further investigated.

### 4.11.2 Gate Packing Replacement

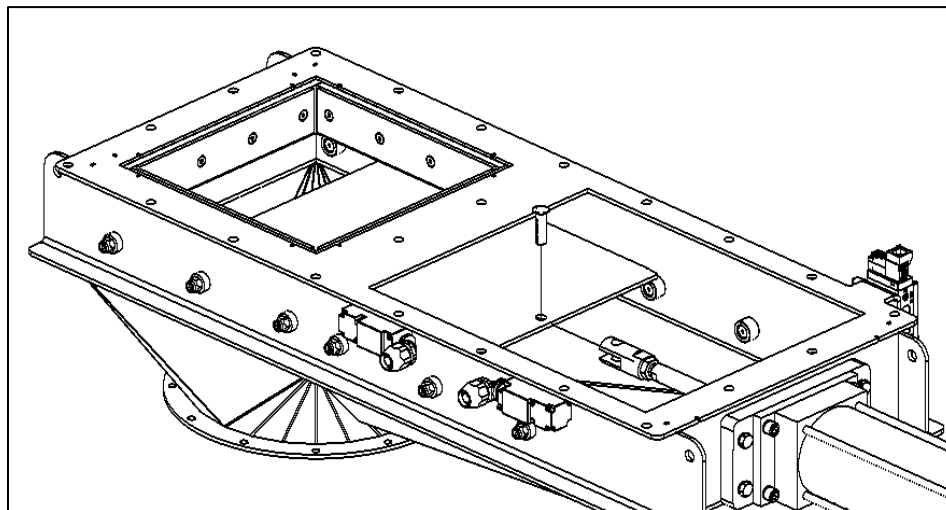
Replacement of the gate blade packing is best accomplished with the gate either removed or at least isolated, especially from internal pressure. However, it is possible to replace the packing “on line”, provided all safety hazards are identified and addressed. The gate blade must be retracted far enough to extract the packing gland follower and allow access to the packing gland. All existing packing should be removed, paying particular attention to that which may have been extruded past the packing gland and into the gate cavity. Remove any product build-up, rust, scale, etc. Install individual wraps of replacement packing, available from **PEBCO®**, compatible with the process application. In most circumstances, three layers of packing are correct, and the layers should fit in place by hand. Install the gland follower, and tighten all adjustment bolts evenly until snug.

## 4.12 BLADE REPLACEMENT

1. Upon receipt of the new blade be sure to review the receiving inspection covered in **Section 3.2**



2. Remove the unit from its operational position and place it in an area that allows for easy access (Refer to **Section 3.3** for mounting procedures).
3. Remove the top cover from the unit to allow access to the blade.
4. Disconnect the blade from the actuator and install the new blade.



**Figure 7:** Blade Removal

5. Reconnect the actuator and replace the top cover.
6. Remount the unit. (Refer to **Section 3.3** for mounting procedures.)

### 4.13 MOUNTING BOLT INSPECTION

Check gate mounting bolts. Replace and/or tighten any loose or missing bolts. Use the same quality of bolts used in installation. This should be done annually.

### 4.14 MUFFLER SPEED CONTROLS

Check and adjust muffler speed control when the cylinder operates slowly or if the muffler shows excessive contamination. Maintenance of the muffler speed control should only be necessary when the muffler becomes restricted. This will be evident due to a slowing of the gate speed. As a preventive measure, the speed control should be checked every three months and cleaned if necessary.

Cleaning can be done with a bath of cleaning solvent. Submerge the muffler in the solvent. After the muffler has soaked for a few minutes, remove it from the solution and blow off the solvent and any residual contaminants.

## 4.15 TROUBLESHOOTING PNEUMATIC ACTUATORS

Pneumatic cylinder operates slowly

- Check air supply pressure-should be 80 to 100 psi
- Muffler speed control restricted, or dirty
- Excessive cylinder leakage
- Tubing to cylinder
- Cushions improperly adjusted

Pneumatic cylinder will not operate

- Air pressure turned off
- Solenoid coil open
- Muffler speed control restricted
- Directional valve spool seized in valve body
- No electrical power to the directional valve coil circuit
- Gross air leakage

Pneumatic cylinder drifts

- Internal cylinder leakage
- Directional valve spool worn
- Loose connection to cylinder ports

Water comes from directional valve exhaust port

- Air source too wet, dew point too low
- Auto drain not functioning
- Drain filter regulator
- Replace air dryer desiccant

Directional valve will not operate when coil is energized

- Coil open
- Valve spool seized
- Internal valve leakage

## 4.16 GATE DISASSEMBLY AND CLEANING

The following steps are required for disassembly and cleaning:

1. Remove the central top and bottom flange plate bolts, and remove the top flange plate gently to avoid destroying the O-ring seal.

2. Extract the blade, clevis, plastic guide plates and wave spring together from the remaining gate assembly. All internal surfaces should be easily accessible without additional disassembly.
3. All parts of the gate are waterproof and can be cleaned with a high-pressure spray. Caked on material can be removed with a stiff brush (not wire) with care not to damage the paint.
4. Allow all parts to completely dry and reassemble by following the above steps in reverse order. For best results, use a new O-ring and wave spring.

## 4.17 HYDRAULIC SYSTEMS

Refer to manufacturer's data sheets on items furnished on this order.

If Hydraulic Power Unit is supplied on this order by **PEBCO®**, refer to the Hydraulic System Manual for detailed operation.

## 5 WARRANTY

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### WARRANTY: PEBCO® SLIDE GATE

#### WARRANTY

**PEBCO®** warrants to purchaser, upon the terms set forth, that the equipment purchased, so far as the same is of **PEBCO®**'s manufacture, is free from defects in material and workmanship under normal use and service for a period of twelve (12) months from the date of shipment. All equipment, including motors, manufactured by others, is warranted solely and exclusively by their manufacturers and not by **PEBCO®**, and **PEBCO®** hereby assigns to purchaser without recourse to **PEBCO®** such warranty as is given by the manufacturer.

#### TERMS

**PEBCO®**'s obligation under this warranty is limited to and shall be fully discharged by **PEBCO®** repairing or at its option replacing f.o.b. point of manufacturer any part which is shown to **PEBCO®**'s satisfaction to have been defective as to material or workmanship, provided that written notice of defect is delivered to **PEBCO®**'s office in Paducah, Kentucky, within sixty (60) days after defect is discovered, and in no event more than twelve (12) months and sixty (60) days after shipment.

#### PURCHASER'S ACTS VOIDING WARRANTY

The warranty furnished by **PEBCO®** herein will be rendered void by improper erection or installation, if executed by other than **PEBCO®**, misuse, unauthorized alteration, substitutions, repairs or modifications, neglect or accident, or damage to the equipment caused by improper storage, abrasion, corrosion, and/or operation outside the rated load limitations for use of the equipment. **PEBCO®** shall not be liable for any repairs, replacements or adjustments to the equipment or any cost of labor performed by the purchaser or others without **PEBCO®**'s prior written approval.

#### EXCLUSION OF ALL OTHER WARRANTIES AND LIMITATION OF CONSEQUENTIAL AND INCIDENTAL DAMAGES.

1. THE WARRANTY FURNISHED BY **PEBCO®** AS EXPRESSLY INCLUDED HEREIN IS IN LIEU OF ANY OTHER WARRANTIES OR GUARANTIES EXPRESSED OR IMPLIED. **PEBCO®** MAKES NO OTHER WARRANTY OR REPRESENTATION OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF DESIGN, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED.
2. IN NO EVENT, BE IT DUE TO A BREACH OF WARRANTY OR ANY OTHER CAUSE ARISING OUT OF PERFORMANCE OR NONPERFORMANCE OF THIS PROPOSAL OR CONTRACT, SHALL **PEBCO®** BE LIABLE FOR (1) CONSEQUENTIAL OR INDIRECT LOSS OR DAMAGE INCLUDING BUT NOT LIMITED TO LOSS OF PROFITS, COSTS TO PURCHASE SUBSTITUTE POWER, PLANT DOWNTIME, PRODUCTION, INCREASED COSTS OF OPERATION, OR SPOILAGE OF MATERIAL, OR (2) LOSS OR DAMAGE ARISING OUT OF THE NEGLIGENCE OF THE PURCHASER, ITS EMPLOYEES, AGENTS, ENGINEERS OR ARCHITECT.

## 6 COMPONENTS

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Component list and manuals available separately, please see “Components Manuals” on our website [www.pebco.com](http://www.pebco.com).

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### **⚠ WARNING**

#### **PERSONAL INJURY**

**DO NOT USE** these products as safety or emergency stop devices, or in any other application where failure of the product could result in personal injury.

**Failure to comply with these instructions could result in death or serious injury.**

### **⚠ WARNING**

#### **OPENING PRODUCTS HAZARD**

**DO NOT OPEN** these products when energized or in a flammable gas atmosphere.

**Failure to comply with these instructions could result in death or serious injury.**

### **⚠ WARNING**

#### **IMPROPER CONDUIT THREAD USE**

**DO NOT USE** any other conduit thread than the one identified on the product. Verify that the mating threaded fitting is identical with the conduit thread shown on the product nameplate.

**Failure to comply with these instructions could result in death or serious injury.**

**MICRO SWITCH™** explosion-proof switches are designed specifically for use in hazardous area applications. In addition to meeting explosion-proof requirements, the MICRO SWITCH™ LSX meets additional enclosure sealing classifications. This makes the LSX ideal for outdoor use or in adverse environments where a combination of explosion proof plus sealing requirements are needed.

The **MICRO SWITCH™ LSX** enclosure is sealed for protection against corrosion, water, dust and oil, as defined in NEMA 1, 3, 4, 6, and 13. These enclosures also meet NEMA standards for hazardous type Div. 1 & 2, Class I, Groups B, C, & D; Div. 1 & 2, Class II, Groups E, F, & G.

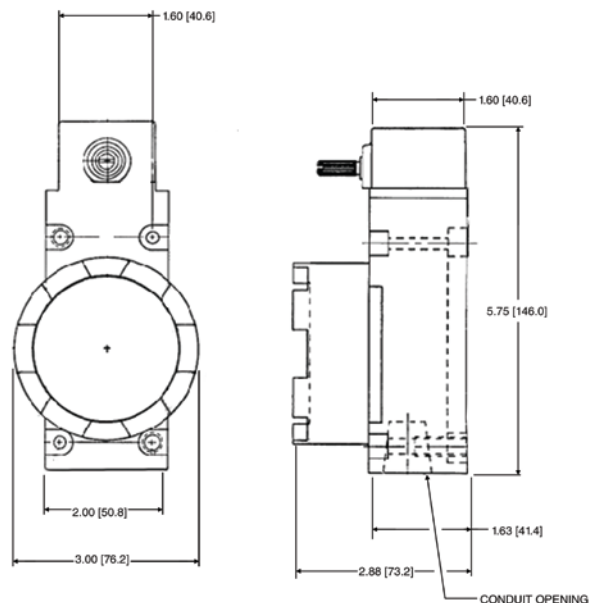
#### **MOUNTING INSTRUCTIONS**

The LSX may be mounted using two 1/4-inch or M6 screws for clearance fit, or two 5/16-18 UNC bolts for threaded fit. Torque threaded fit bolts to 12 in-lb to 16 in-lb [1.4 Nm to 1.8 Nm]. See Figure 2.

**Figure 1. MICRO SWITCH™ LSX Terminology**



**Figure 2. MICRO SWITCH™ LSX General Dimensions**



### MOUNTING INSTRUCTIONS: HDLS Mounting

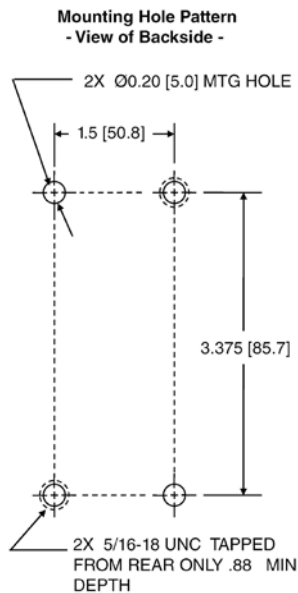
If it is desired to mount on existing HDLS mounting hole locations, the adapter plate (Catalog Listing: LSXZ4022) must be used. The adapter plate is attached to the HDLS location.

Position the plate so the screw heads fit into the plate recesses provided. Now simply attach the MICRO SWITCH™ LSX to the adapter plate using two 3/16-inch screws and the smaller mounting holes. The mounting plate fits into the recess in the back of the LSX. It is good practice not to mount the switch upside down or at the low point of long conduit runs.

### MOUNTING INSTRUCTIONS: NEW INSTALLATIONS

Note the mounting dimensional drawing (Figure 3) for hole locations.

**Figure 3. MICRO SWITCH LSX Mounting Hole Pattern**



### WIRING INSTRUCTIONS

The circular cover on the front of the switch is unthreaded to expose the switching element for wiring or replacement. To aid in cover removal, a screwdriver or bar may be used on the wrenching lugs.

Use up to size #12 AWG solid or standard wire to connect to the pressure type connector terminals. Stripped wire ends or any spade and ring connector that will fit LS terminals may be used. Spades may be up to 0.312 inch wide, rings up to 0.312 inch diameter. With spade or ring-type connections, pre-insulated connectors or heat-shrinkable tubing should be used to provide insulation between terminals. Circuit diagram is shown on nameplate.

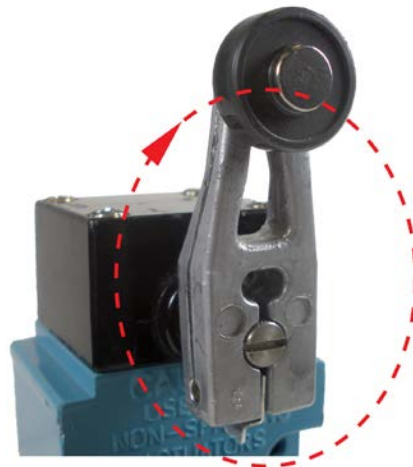
It will be easier to wire the double pole units by connecting lead wires to the terminals nearest the conduit opening first.

A grounding screw is located on the right side. The internal grounding terminal must be used for the equipment grounding connection. After wiring, replace cap so that the o-ring gasket is fully seated.

### ADJUSTING INSTRUCTIONS: ACTUATOR HEAD

To give flexibility in application, the actuator head may be positioned in any of four directions. Loosen the four captive head screws, place the head in the desired position, and then securely tighten the four screws. The screw tightening torque is 12 in-lb to 16 in-lb [1.4 Nm to 1.8 Nm].

**Figure 4. MICRO SWITCH™ LSX Side Rotary Head**



### REVERSING THE ROLLER LEVER

Except for the offset roller levers, the roller arm may be reversed to face the roller to the inside or outside of the arm.



### POSITIONING LEVER

The lever on rotary-actuated units is adjustable to any position through 360° around the shaft. Loosen the cap screw with a 9/64-inch hexagon key wrench, move the lever to desired position and securely tighten screw (Figure 4). A 9/64-inch hex key wrench is provided in the adjusting tool set LSZ4005.

### ADJUSTABLE LENGTH LEVERS

To adjust the length of the adjustable length levers, a 9/64-inch hexagon key wrench is required. A 9/64-inch hex key wrench is provided in the adjusting tool set LSZ4005.

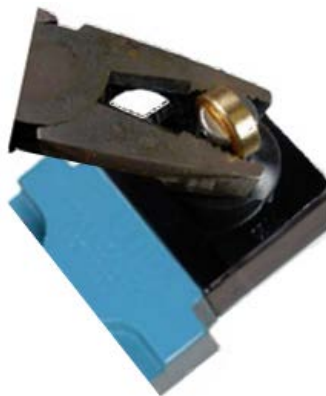
### TOP ROLLER PLUNGER

Position the top roller plunger in the desired roller plane, by adjusting the head as explained under actuator head.

### SIDE ROLLER PLUNGER

Grasp the plunger with a pair of pliers and rotate to the desired horizontal or vertical position (Figure 5).

**Figure 5. MICRO SWITCH™ LSX Side Roller Plunger**



### CHANGING DIRECTION OF ACTUATION SIDE ROTARY

Catalog listings with the first four letters LSXA, LSXH, LSXL, LSXP, and LSXR may be adjusted to operate clockwise, counter-clockwise, or both. Catalog listings LSXM (center neutral) and LSXN (maintained) operate in both directions and cannot be changed. To change, follow these steps:

1. Loosen the head screws and remove the head from the switch housing.
2. On the bottom of the head, insert a screwdriver in the slot provided and lift open the hinged cover.
3. Refer to Figure 8, slide the cam all the way back and away from the exterior portion of the actuator shaft, so cam is free to rotate on the shaft.
4. Using a screwdriver or similar tool, rotate the cam to desired actuating position. See Figures 7, 8, & 9.
5. Slide the cam all the way forward to its original position, and close the hinged cover.
6. Replace the operating head on the switch housing and securely tighten the head screws. The screw tightening torque is 12 in-lb to 16 in-lb [1.4 Nm to 1.8 Nm].

**Figure 6. MICRO SWITCH™ LSX Side Rotary Actuator head Terminology**

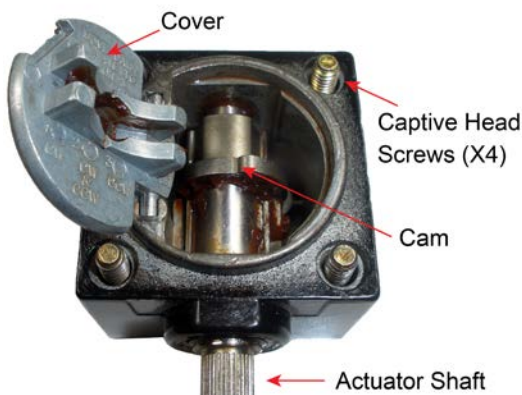


Figure 7. MICRO SWITCH™ LSX Cam Slide

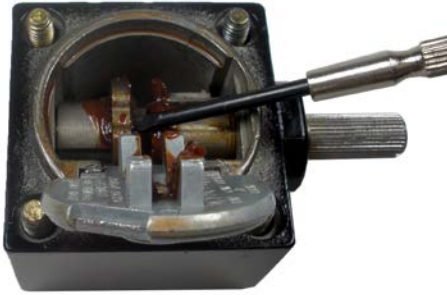


Figure 8. MICRO SWITCH™ LSX Cam Lobes for CW and CCW



Figure 9. MICRO SWITCH™ LSX Cam Lobe for CCW



Figure 10. MICRO SWITCH™ LSX Cam Lobe for CW



#### TOP ROTARY

Follow these steps to change the operating direction of the LSXB type switch:

1. Loosen the head screws and remove head from the switch housing.
2. From the bottom of the head, grasp the end of the pin plunger (Figure 11) and remove the pin. It may be necessary to rotate the actuating shaft to expose the end of the pin plunger.
3. Using Figure 11 as a position reference orientate the pin plunger according to Figure 12, select the correct pin plunger position for the desired direction of actuation.
4. Insert the pin plunger in the position providing the desired direction of actuation.
5. Replace the operating head on the switch housing and securely tighten the head screws.

Figure 11. MICRO SWITCH™ LSX Top Rotary Actuator

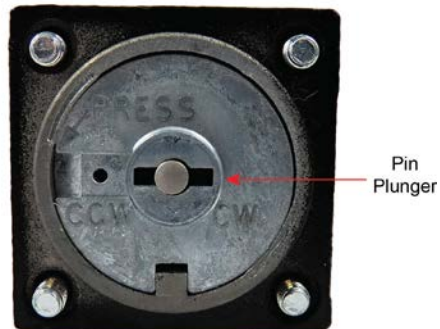


Figure 12. MICRO SWITCH™ LSX Top Rotary Actuation Diagram

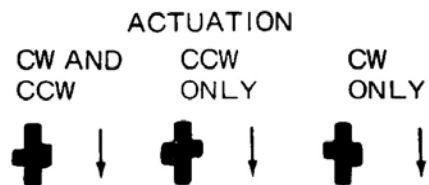
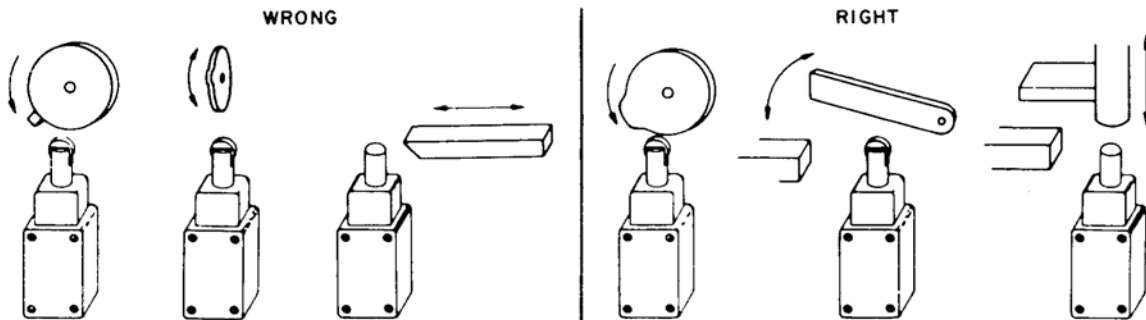
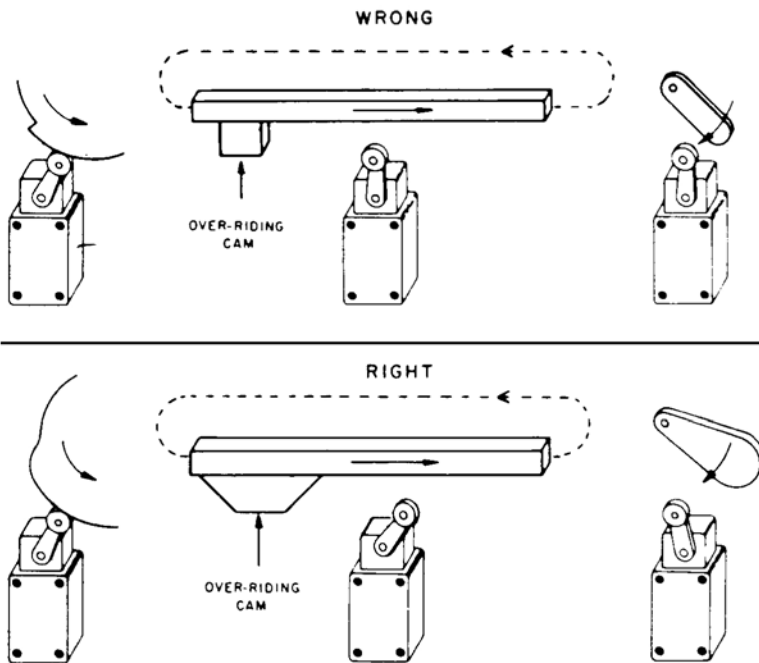


Figure 13. Proper Application of Limit Switches




For limit switches with pushrod actuators, the actuating force should be applied as nearly as possible in line with the pushrod axis.



Cam or dog arrangements should be such that the actuator is not suddenly released to snap back freely.

## REPLACEMENT PARTS

Following is a list of replacement parts for the heavy duty LS switches. Should your specific switch catalog listing not appear in this list, contact the nearest local Honeywell Authorized Distributor or a Honeywell Branch Office. 

For ease of making switch adjustments which may be necessary on various switch listings, it is recommended to order the Lever and Switch Adjusting Tool Set (Catalog Listing: LSZ4005). This set consists of (1) special 3/32-inch open end wrench, and (1) 9/64-inch hexagon key wrench.

## REPLACEMENT LEVERS

To order replacement levers, order the same part number as that which is metal stamped on either the lever or lever hub. Use only non-sparking levers to retain the explosion proof qualities.

## ADAPTER MOUNTING PLATE

Catalog Listing: LSXZ4022

## NON-PLUG IN

Catalog listing* on switch nameplate	Operating head only	Contact block (basic switch only)
LSXA3K	LSZ1A	LSXZ3K
LSXA4L	LSZ1A	LSXZ3L
LSXB3K	LSZ1B	LSXZ3K
LSXB4L	LSZ1B	LSXZ3L
LSXC3K	LSXZ1C	LSXZ3K
LSXC4L	LSXZ1C	LSXZ3L
LSXD3K	LSXZ1D	LSXZ3K
LSXD4L	LSXZ1D	LSXZ3L
LSXE3K	LSXZ1E	LSXZ3K
LSXE4L	LSXZ1E	LSXZ3L
LSXF3K	LSXZ1F	LSXZ3K
LSXF4L	LSXZ1F	LSXZ3L
LSXH3K	LSZ1H	LSXZ3K
LSXH4L	LSZ1H	LSXZ3L
LSXJ3K-7A	LSZ1JGA	LSXZ3K
LSXJ4L-7A	LSZ1JGA	LSXZ3L
LSXK3K-8A	LSXZ1KHA	LSXZ3K
LSXK4L-8A	LSXZ1KHA	LSXZ3L
LSXL4M	LSZ1L	LSXZ3M
LSXM4N	LSZ1M	LSXZ3M
LSXN3K	LSZ1N	LSXZ3K
LSXN4L	LSZ1N	LSXZ3L
LSXP3K	LSZ1P	LSXZ3K
LSXP4L	LSZ1P	LSXZ3L
LSXR3K	LSZ1R	LSXZ3K
LSXR4L	LSZ1R	LSXZ3L

\*Above, only a portion of Catalog listing is shown to determine the replacement part. Listings shown with -7A, or -8A are complete listings.

**WARRANTY/REMEDY**

Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship. Honeywell's standard product warranty applies unless agreed to otherwise by Honeywell in writing; please refer to your order acknowledgement or consult your local sales office for specific warranty details. If warranted goods are returned to Honeywell during the period of coverage, Honeywell will repair or replace, at its option, without charge those items it finds defective. **The foregoing is buyer's sole remedy and is in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular purpose. In no event shall Honeywell be liable for consequential, special, or indirect damages.**

While we provide application assistance personally, through our literature and the Honeywell web site, it is up

to the customer to determine the suitability of the product in the application.

Specifications may change without notice. The information we supply is believed to be accurate and reliable as of this printing. However, we assume no responsibility for its use.

Honeywell serves its customers through a worldwide network of sales offices, representatives and distributors. For application assistance, current specifications, pricing or name of the nearest Authorized Distributor, contact your local sales office or:

**E-mail:** [info.sc@honeywell.com](mailto:info.sc@honeywell.com)

**Internet:** [www.honeywell.com/sensing](http://www.honeywell.com/sensing)

**Phone and Fax:**

USA/Canada +1-800-537-6945

International +1-815-235-6847

+1-815-235-6545 Fax

## Series C5 Valves

Repair Kit No.	For valve type
C-4202-SI	CSI-
C-4202-SL	CSL-
C-4202-ZI	CZI-
C-4202-ZL	CZL-
C-4203-BI	CBI-w/ 3 spool
C-4203-BL	CBL- w/ 3 spool
C-4203-UI	CUI-w/ 3 spool
C-4203-UL	CUL-w/ 3 spool
C-4204-BI	CBI-w/ 4 spool
C-4204-BL	CBL- w/ 4 spool
C-4204-UI	CUI-w/ 4 spool
C-4204-UL	CUL-w/ 4 spool
C-4222-PP	CGG- & CPP-
C-4222-SP	CSG- & CSP-
C-4223	CXX- & CJJ- w/ 3 spool
C-4224	CXX- & CJJ- w/ 4 spool

## Series C7 Valves

Repair Kit No.	For valve type
C-4302-SI	CSI-
C-4302-SL	CSL-
C-4302-ZI	CZI-
C-4302-ZL	CZL-
C-4303-BI	CBI-w/ 3 spool
C-4303-BL	CBL- w/ 3 spool
C-4303-UI	CUI-w/ 3 spool
C-4303-UL	CUL-w/ 3 spool
C-4304-BI	CBI-w/ 4 spool
C-4304-BL	CBL- w/ 4 spool
C-4304-UI	CUI-w/ 4 spool
C-4304-UL	CUL-w/ 4 spool
C-4322-PP	CGG- & CPP-
C-4322-SP	CSG- & CSP-
C-4323	CXX- & CJJ- w/ 3 spool
C-4324	CXX- & CJJ- w/ 4 spool

## Series C9 Valves

Repair Kit No.	For valve type
C-4522-PP	CGG- & CPP-
C-4522-SP	CSG- & CSP-
C-4523	CXX- & CJJ- w/ 3 spool
C-4524	CXX- & CJJ- w/ 4 spool

VALVE TYPE	SERIES	SOLENOID TYPE	COIL TYPE	COIL PRODUCT NUMBER
Manifold Mounting or Body ported	C5 C7	Standard	3 spade terminals **	P-1005-02-HC-(* )
			Wire Leads	P-1005-02-243-(* )
			Wire Leads with 1/2" NPT conduit connection	P-1005-02-228L-(* )
	C5 C7	Low-Watt	3 spade terminals ††	†P-1520-02-027-HC-(* ) †P-1520-02-043-HC-(* )
	C5 C7		Wire Leads	†P-1520-02-027-243-(* ) †P-1520-02-043-243-(* )
	C9	Standard	3 spade terminals ††	P-1580-02-HC-(* )

\* Add coil code from page 13

\*\* DIN connectors for this coil is P-1005-70-HC

† Match coil to valve product number using -027 or -043 designation (see page 7 for part number)

†† DIN connectors C5/C7 is P-1520-70-HC, C9 is P-1005-70-HC



**Komline-Sanderson**

12 Holland Av Peapack, NJ 07977-0257  
908-234-1000 Fax: 908-234-9487  
www.komline.com

## OPERATION AND MAINTENANCE MANUAL

Title of Project: Lake County Public Works Department  
Des Plaines River WRF  
Phases 2B & 3 Improvements

Specification Number: 11650G Paragraph 2.4 G  
Detail Biosolids Thermal Drying System  
Truck Loading Spouts  
Tags: M-12-6, M-12-12-9 & M-12-12

Manufacturer: PEBCO

General Contractor: Williams Brothers Construction

Subcontractor:

Supplier: Komline-Sanderson

# **MANUAL: INSTALLATION, START-UP, MAINTENANCE**

---

**THIS MANUAL PREPARED FOR:  
KOMLINE-SANDERSON  
BOX 257  
12 HOLLAND AVE  
PEAPACK, NJ 07977**

**PROJECT:  
LAKE COUNTY DES PLAINES RIVER  
WRF  
800 KRAUSE DRIVE  
BUFFALO GROVE, IL 60089**

**PURCHASE ORDER NUMBER:  
PO 85540**

**PEBCO®FILE #174314  
EQUIPMENT: DLS-22-8-OT  
TRUCK LOADING SPOUTS**

**TAG #'S:**

**M-12-6  
M-12-9  
M-12-12**

**PERSONNEL SHOULD READ THIS MANUAL IN ITS ENTIRETY AND BECOME FAMILIAR WITH THE EQUIPMENT AND ITS COMPONENTS BEFORE ATTEMPTING OPERATION OR MAINTENANCE.**



O&M MANUAL SUBMITTAL CHECKLIST (Page 1 of 5)

PROJECT NAME Des Plaines River WRF

CONTRACT NO. K-S Job D0493

CONTRACTOR Komline-Sanderson

EQUIPMENT/SYSTEM Truck Loading Spouts

SECTION NO. 11650H

MANUFACTURER/VENDOR PEBCO

FORMAT

Size: 8-1/2 x 11 or 11 x 17  
 Paper: 20-pound minimum  
 Text: Printed data/neatly typed  
 Drawings: Standard size bound in text; in text-size labeled envelopes

Tabbed Section Dividers

Cover Label: Title  
 Project Name  
 Building/Structure ID  
 Equipment Name  
 Specification Section

Binders: Plastic Cover

O&M MANUAL SUBMITTAL CHECKLIST (Page 2 of 5)

GENERAL CONTENTS

<u>Provided</u>	<u>Not Applicable</u>	<u>Page No.</u>	
	X	1	One Specification Only
X		1	Title Page:
X		1	Title
X		1	Project title
	X		Building/structure ID
X			Equipment name
X		1	Specification section number
X		1	Contractor ID
	X		Subcontractor ID
	X		Purchase order data
X		3	Manufacturer ID
X		3	Service/parts supplier ID
	X		Product List
	X		Table of Contents
	X		Tabbed Sections:
	X		Pertinent data sheets
	X		Annotated as needed
	X		Text:
	X		Pertinent to project
	X		Annotated
X		12	Drawings:
X		12	Illustrate product and components
	X		Control and flow diagrams
			Special Information:
X		Varies	Interrelationships of equipment and components
X		Varies	Instructions and procedures
X		Varies	Instructions organized in
X		Varies	Instructions in logical
	X		Glossary
	X		Warranty, Bond, Service Contract

O&M MANUAL SUBMITTAL CHECKLIST (Page 3 of 5)

MANUAL FOR MATERIALS AND FINISHES

<u>Provided</u>	<u>Not Applicable</u>	<u>Page No.</u>	
_____	<u>X</u>	_____	Building Products:
_____	<u>X</u>	_____	Product data
_____	<u>X</u>	_____	Catalog number
_____	<u>X</u>	_____	Size
_____	<u>X</u>	_____	Composition
_____	<u>X</u>	_____	Color and texture designations
_____	<u>X</u>	_____	Care and Maintenance Instructions
_____	<u>X</u>	_____	Recommended cleaning agents and methods
_____	<u>X</u>	_____	Cleaning precautions
_____	<u>X</u>	_____	Cleaning and maintenance schedule
_____	<u>X</u>	_____	Moisture Protection Products:
_____	<u>X</u>	_____	Product data listing
_____	<u>X</u>	_____	Chemical composition
_____	<u>X</u>	_____	Installation details
_____	<u>X</u>	_____	Inspection recommendations
_____	<u>X</u>	_____	Maintenance and repair
_____	<u>X</u>	_____	Additional Data as Required

O&M MANUAL SUBMITTAL CHECKLIST (Page 4 of 5)

MANUAL FOR EQUIPMENT AND SYSTEMS

<u>Provided</u>	<u>Not Applicable</u>	<u>Page No.</u>	
<u>X</u>	<u>      </u>	<u>Varies</u>	Description of Unit and Components:
<u>X</u>	<u>      </u>	<u>Varies</u>	Equipment functions
<u>      </u>	<u>X</u>	<u>      </u>	Normal operating characteristics
<u>      </u>	<u>X</u>	<u>      </u>	Limiting conditions
<u>      </u>	<u>X</u>	<u>      </u>	Performance curves
<u>X</u>	<u>      </u>	<u>Varies</u>	Engineering data
<u>      </u>	<u>X</u>	<u>      </u>	Test data
<u>X</u>	<u>      </u>	<u>11,167</u>	Replaceable parts list (with numbers)
<u>      </u>	<u>X</u>	<u>      </u>	P&ID numbers
<u>      </u>	<u>      </u>	<u>      </u>	Operating Procedures:
<u>X</u>	<u>      </u>	<u>Varies</u>	Startup
<u>X</u>	<u>      </u>	<u>Varies</u>	Break-in
<u>X</u>	<u>      </u>	<u>Varies</u>	Routine/normal operation
<u>X</u>	<u>      </u>	<u>Varies</u>	Regulation and control
<u>X</u>	<u>      </u>	<u>Varies</u>	Stopping and shutdown
<u>X</u>	<u>      </u>	<u>Varies</u>	Emergency
<u>      </u>	<u>X</u>	<u>      </u>	Seasonal operation
<u>      </u>	<u>X</u>	<u>      </u>	Special instructions
<u>      </u>	<u>      </u>	<u>      </u>	Maintenance Procedures:
<u>X</u>	<u>      </u>	<u>Varies</u>	Routine/normal instructions
<u>X</u>	<u>      </u>	<u>Varies</u>	Troubleshooting guide
<u>X</u>	<u>      </u>	<u>Varies</u>	Disassembly/reassembly/repair
<u>      </u>	<u>X</u>	<u>      </u>	Alignment/adjusting/balancing
<u>      </u>	<u>      </u>	<u>      </u>	Servicing and Lubrication:
<u>X</u>	<u>      </u>	<u>10, 124</u>	List of lubricants
<u>X</u>	<u>      </u>	<u>10,124</u>	Lubrication schedule
<u>X</u>	<u>      </u>	<u>32,98</u>	Maintenance schedule
<u>X</u>	<u>      </u>	<u>Varies</u>	Safety Precautions/Features
<u>      </u>	<u>X</u>	<u>      </u>	Sequence of Operation of Controls
<u>X</u>	<u>      </u>	<u>12</u>	Assembly Drawings
<u>X</u>	<u>      </u>	<u>Varies</u>	Parts List and Illustrations:
<u>      </u>	<u>X</u>	<u>      </u>	Predicted life
<u>X</u>	<u>      </u>	<u>11, 167</u>	Recommended spare parts list and prices
<u>      </u>	<u>X</u>	<u>      </u>	Control Diagrams/Schematics
<u>X</u>	<u>      </u>	<u>Varies</u>	Bill of Materials

O&M MANUAL SUBMITTAL CHECKLIST (Page 5 of 5)

<u>Provided</u>	<u>Not Applicable</u>	<u>Page No.</u>	
<u>X</u>	<u>      </u>	<u>8</u>	Completed Equipment Data Form per Specification
<u>      </u>	<u>X</u>	<u>      </u>	Valves
<u>X</u>	<u>      </u>	<u>1,2</u>	Catalog Cuts and Tag Numbers
<u>X</u>	<u>      </u>	<u>Varies</u>	Maintenance Instructions
<u>      </u>	<u>      </u>	<u>      </u>	Panelboard Directories:
<u>      </u>	<u>X</u>	<u>      </u>	Electrical
<u>      </u>	<u>X</u>	<u>      </u>	Controls
<u>      </u>	<u>X</u>	<u>      </u>	Communications
<u>      </u>	<u>X</u>	<u>      </u>	Instrumentation Loops:
<u>      </u>	<u>X</u>	<u>      </u>	Diagrams
<u>      </u>	<u>X</u>	<u>      </u>	Components list each circuit/loop
<u>      </u>	<u>X</u>	<u>      </u>	Additional Data As Required

EQUIPMENT DATA FORM (Page 1 of 3)

PROJECT NAME Des Plains River WRF

CONTRACT NO. K-S Job D0493

CONTRACTOR Komline-Sanderson

EQUIPMENT NO. M-12-6, M-12-9, M-12-12

DESCRIPTION Truck Loading Spouts

LOCATION 800 Krause Drive, Buffalo Grove, IL 60089

MANUFACTURER PEBCO

PURCHASED FROM PEBCO PURCHASE DATE 11/09/2015

VENDOR ORDER NO. \_\_\_\_\_ PURCHASE PRICE \$73,230

LOCAL SUPPLIER PEBCO PHONE 270- 442-1996

ADDRESS 3885 Coleman Road , Paducah, KY 42001

MODEL NO. DLS-2-8-OT SHIPPING WT/UNIT 850 lbs each

NO. OF UNITS 3 SERIAL NOS. 22388

NAMEPLATE DATA

<u>ELECTRIC MOTOR</u>	<u>PUMP/HVAC UNIT</u>	<u>DRIVE/REDUCER</u>	<u>OTHER (I&amp;C)</u>
MANUFACTURER:	MANUFACTURER:	MANUFACTURER:	MANUFACTURER:
<u>Nord</u>	_____	<u>Nord</u>	_____
TYPE: [ <input checked="" type="checkbox"/> ]AC [ <input type="checkbox"/> ]DC	TYPE _____	TYPE: [ <input checked="" type="checkbox"/> ]GEAR	TYPE _____
HP <u>1</u>	SIZE _____	<input type="checkbox"/> V-BELT	SIZE _____
RPM <u>1750</u>	CAPACITY _____	<input type="checkbox"/> CHAIN	CAPACITY _____
VOLTAGE <u>460</u>	PRESSURE _____	<input type="checkbox"/> VARIDRIVE	
AMPERAGE <u>1.94</u>	ROTATION _____	SERVICE FACTOR <u>0.8</u>	RANGE _____
PHASE <u>3</u>	IMPELLER:	RATIO <u>100:1</u>	
	SIZE _____		
FRAME <u>B5</u>	MATERIAL _____		

EQUIPMENT DATA FORM (Page 2 of 3)

MAINTENANCE SUMMARY

EQUIPMENT NO. M-12-6, M-12-9, M-12-12

DESCRIPTION Truck Loading Spouts

MAINTENANCE OPERATION

List briefly each maintenance operation required and refer to specific information in Manufacturer's Maintenance Manual, if applicable. Refer by symbol to "Lubricant List" for Lubrication Operation.

FREQUENCY

List required frequency of each maintenance operation.

Visually Check for Loose Hardware

Weekly

Grease Flange Bearings

Monthly

Tool Check Air Vibrator Mounting Bolts

Monthly

Tool Check for Loose Hardware

Quarterly

Check Gear Reducer Oil Level

Quarterly

Grease Drive Bearings

Quarterly

Check Electric Motor

Quarterly

Check Limit Switches

Quarterly

Check all Wiring for Fraying or Damage

Yearly

Inspect Mounting Bolts

Yearly

See Also Nord Gearmotor Manual Section 5 for Service and Maintenance





## Recommended Spare Parts

Certified Drawing No. 22388

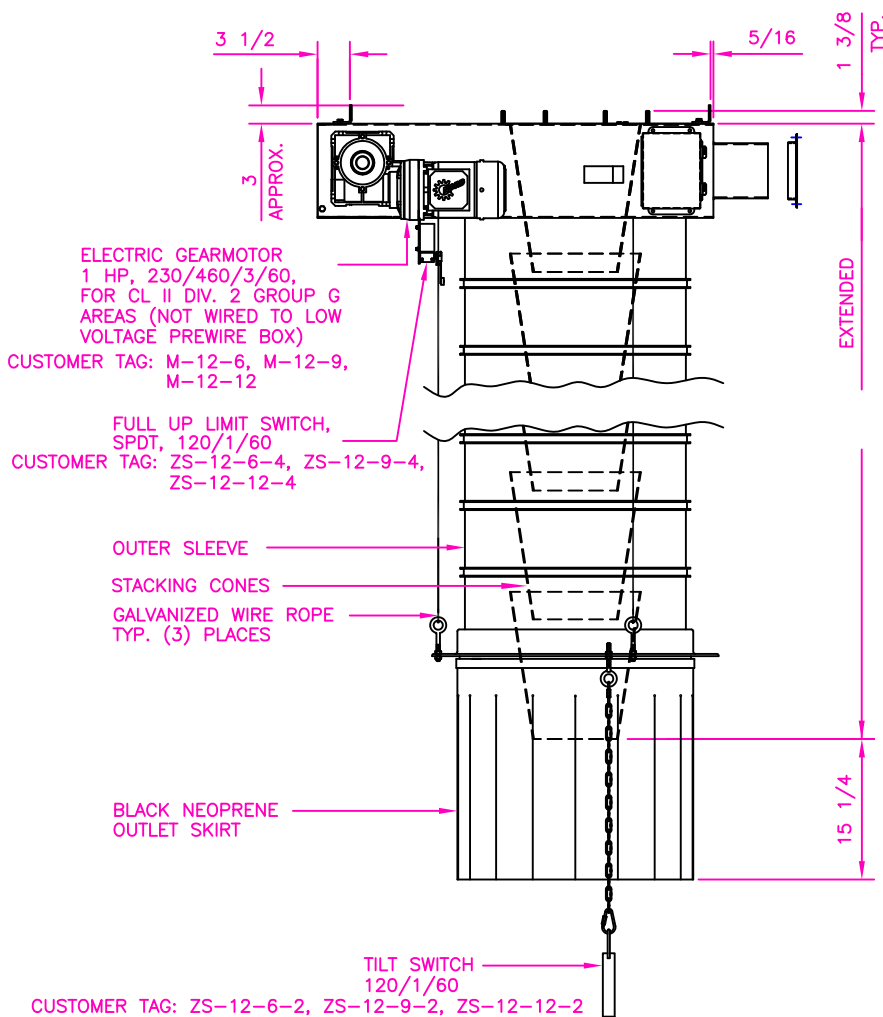
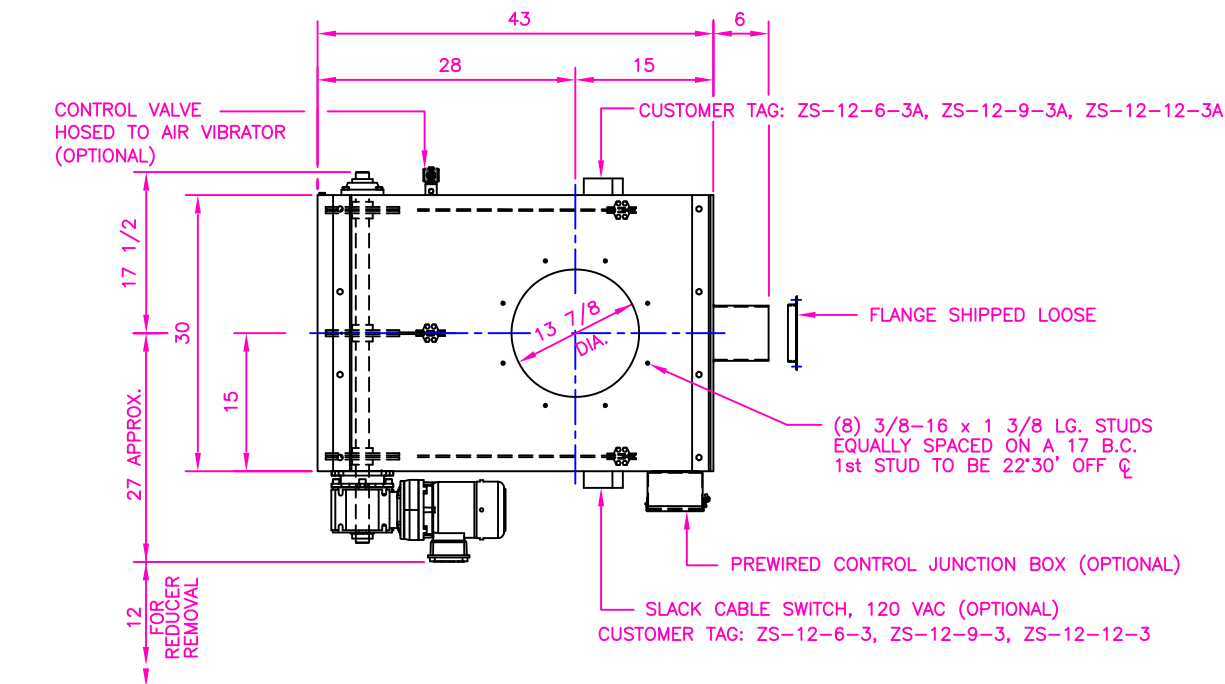
Date: 9/19/2016

Model No. DLS-22-8-OT

Page 1 of 1

<u>Item No.</u>	<u>Description</u>	<u>Part No.</u>	<u>Quantity Each</u>	<u>Price Each</u>
1	MOTOR/REDUCER COMBO	22388-GEAR MOTOR	1	\$1143.00
2	SET COLLAR	2C143	8	\$6.00
3	TILT SWITCH	22388-TILT SWITCH	1	\$730.00
4	TILT SWITCH CORD	7088K233	2	\$137.00
5	FULL-UP LIMIT SWITCH	LSXA3K	2	\$375.00
6	FLANGE BEARING	UCF-207-33	1	\$13.00
7	STACKING CONE	DLS22-4-ST-AR4	8	\$390.00
8	SLACK CABLE SWITCH	LSXD3K	2	\$487.00
9	CABLE PULLEY	RA4501CB0001	3	\$21.00
10	CONE CABLE	22388-CCABLE	1 SET	\$280.00
11	LIFT CABLE	222388-LCABLE	1 SET	\$250.00
12	SKIRT ASSEMBLY	22388-SKIRT	1	\$850.00
13	OUTER SLEEVE ASSEMBLY	22388-DLS-22-6-A	1	\$1707.00

**TO ORDER SPARE PARTS PLEASE CONTACT PEBCO® AT (270) 442-1996 AND ASK FOR SPARE PARTS DEPARTMENT.  
PLEASE REFER TO PEBCO® FILE #174314.  
PRICES GOOD FOR 30 DAYS.**



TRAVEL (ft)	EXTENDED	RETRACTED
2	50 1/2	26 1/2
3	64 1/2	28 1/2
4	78 1/2	30 1/2
5	92 1/2	32 1/2
6	106 1/2	34 1/2
7	120 1/2	36 1/2
8	134 1/2	38 1/2
9	148 1/2	40 1/2
10	162 1/2	42 1/2
11	176 1/2	44 1/2
12	190 1/2	46 1/2
13	204 1/2	48 1/2
14	216 1/2	50 1/2
15	232 1/2	52 1/2

## MATERIALS OF CONSTRUCTION:

MOTOR HP
3/4
1
1 1/2

MOTOR VOLTAGE
230/460/3/60
415/3/50
575/3/60

ROTARY SWITCH
NONE
SPDT
DPDT

CONE MATERIAL
AR235 CLASS
AR400 CLASS
304 S.S.
316 S.S.
A-36
POLYETHYLENE
URETHANE
GROUNDING STRAPS

SLEEVE MATERIAL
VINYL COATED POLYESTER
COVERLIGHT CSM
NEOPRENE COATED NYLON
SILICONE COATED FIBERGLASS
GROUNDING STRAPS

RING MATERIAL
ALUM. INNER & OUTER
304 S.S. INNER/UHMW OUTER
316 S.S. INNER/UHMW OUTER
304 S.S. INNER/ALUM. OUTER
316 S.S. INNER/ALUM. OUTER

## OPTIONS:

SLACK CABLE SWITCH
NONE
ONE
TWO
NEMA 4 & 4X
NEMA 7 & 9

TILT SWITCH
NONE
ONE
CARBON STEEL
STAINLESS
PVC
FLOAT BALL
INTRINSICALLY SAFE
DUCTILE IRON W/ CHROME NICKEL FINISH

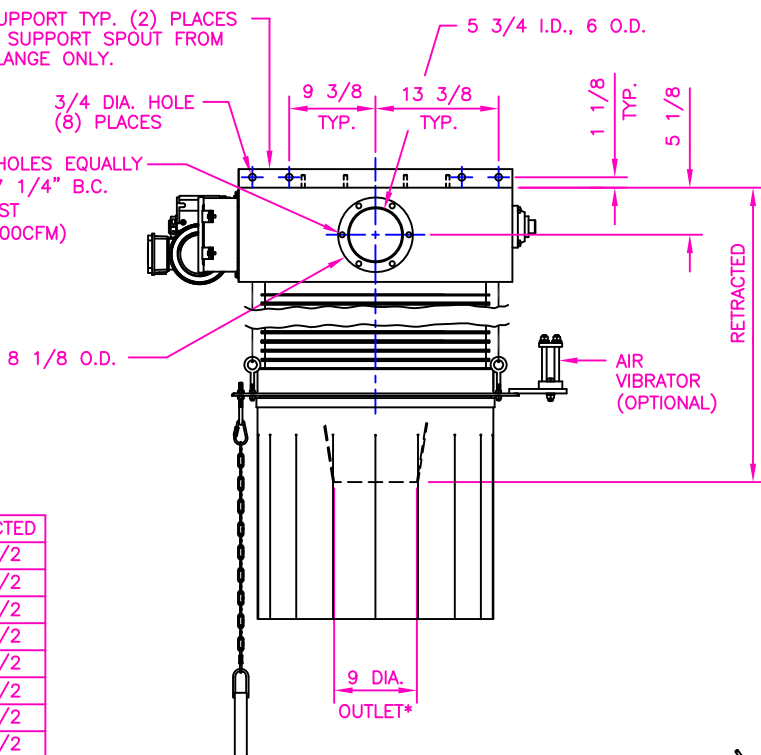
AIR VIBRATOR & VALVE
NONE
ONE, 120 VAC
ONE, 24 VDC

PREWIRED JUNCTION BOX
NONE
ONE, NEMA 4
ONE, NEMA 4X
ONE, NEMA 9

PENDANT STATION
NONE
ONE, SHIPPED LOOSE
UP/DOWN P.B.'s
TILT INDICATOR LIGHT
OPEN/CLOSED P.B.'s
OTHER - SPECIFY

FIELD SUPPORT TYP. (2) PLACES DO NOT SUPPORT SPOUT FROM INLET FLANGE ONLY.

(6) 9/32 DIA. HOLES EQUALLY SPACED ON A 7 1/4" B.C. (SUGGESTED DUST COLLECTION : 800CFM)



CUSTOMER : KOMLINE-SANDERSON

CUSTOMER P.O. No. : 85540

PEBCO JOB No. : 174314

PEBCO SERIAL No. : 22388

PRODUCT : DRIED BIOSOLIDS  
DENSITY : 45-55 PCF  
SIZE : 1-10mm  
TEMP. : 120°F  
FLOW RATE : 20 STPH

FINISH :  
PER SECTION 09900 SYSTEM 6 OF  
CUSTOMERS SPECIFICATION :  
CLEAN PER SSPC-SP6  
1st COAT - COROTECH WATERBORNE  
BONDING PRIMER V175, 1.5 to 2.1 mil DFT  
2nd COAT - COROTECH V400 POLYAMIDE  
HIGH BUILD EPOXY, 4 to 5.2 mil DFT  
3rd COAT - COROTECH V515 ALIPHATIC ACRYLIC  
URETHANE, RAL 6018, 2 to 2.2 mil DFT  
TOTAL DFT : 7.5 to 9.5 mil

APPROX. WEIGHT : 850 LBS. PER SPOUT

QTY. : (3)

EQUIPMENT TAG NoS : M-12-6, M-12-9,  
M-12-12

SHIPPED LOOSE ITEMS :  
(24) 3/8-16 HEX NUTS & SPLIT LOCK  
WASHERS FOR MOUNTING SPOUT TO RSX-14  
REF. PEBCO JOB #177214

CERTIFIED

REV.	DESCRIPTION	BY	DATE	CHECKED BY	DATE	SCALE	JOB No.	THIS DRAWING IN DESIGN AND DETAIL IS THE PROPERTY OF PEBCO, AND MUST BE USED ONLY IN CONNECTION WITH OUR WORK. ALL RIGHTS OF DESIGN OR INVENTION ARE RESERVED.	PEBCO® P.O. BOX 7506 PADUCAH, KY. 42002-7506 (270) 442-1996 FAX (270) 442-5214 www.pebco.com	DUSTLESS LOADING SPOUT MODEL #DLS-22-8-OT	DRAWING NO.	SHT.	REV.
C	ADDED COMPONENT TAG NUMBERS, UPDATED VIEWS, ISSUED CERTIFIED	JDB	2.25.2016	JRW	2.23.2016	3/32 (D)	174314	DRAWN : JRW 11.12.2015					
B	REMOVED TILT SWITCH BARRIER PER CUSTOMERS REQUEST, ADDED MOTOR DATA, ADDED ADDITIONAL FINISH INFORMATION	JRW	1.21.2016	CM	1.21.2016			CHECKED : CM 11.18.2015					
A	CHANGED PRODUCT SIZE, PRODUCT TEMPERATURE & FINISH, ADDED TILT SWITCH VOLTAGE & MATERIAL	JRW	12.3.2015	CM	12.3.2015			RELEASED : CM 02.23.2016					



**DUSTLESS LOADING and  
SELF-CONTAINED DUSTLESS LOADING SPOUTS  
MANUAL**

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# 1 MANUAL OVERVIEW

---

## 1.0 MANUAL CONTENTS

This Section of the manual will familiarize you with the contents of the other manual sections. This manual is general in approach and may not include everything you want to know about the specifics of your particular application. Specific technical information can be found on the drawings which are a part of this manual.

If you have any questions, which cannot be answered by the written material provided, call **PEBCO®** (270) 442-1996 or FAX (270) 442-5214.

## 2.0 PRODUCT OVERVIEW

**Section 2** details both standard and optional components for **PEBCO®** Dustless Loading Spout (DLS) and Self-Contained Dustless Loading Spout (SCDLS) units.

## 3.0 STORAGE RECOMMENDATIONS

**Section 3** covers recommendations for proper storage. In some cases, scheduling requirements or construction delays result in the equipment being stored prior to installation. The guidelines suggested in this section are to aid the installer in selection of proper storage conditions. Because of variability in site conditions/facilities, proper equipment storage/protection is the responsibility of the purchaser or his agent.

**PEBCO®** is not responsible for any equipment damage which results from inadequate storage/protection efforts.

## 4.0 GENERAL INSTALLATION

**Section 4** covers installation and start-up procedures. Pay special attention to the **!!! WARNING !!!** in **Section 4.2**. Generally, installation of DLS systems requires working aloft, and may require applying power to the unit to move between the retracted and extended positions of the spout. Extreme care and good safety procedures should be used whenever working at height or around moving equipment.

## 5.0 OPERATION

**Section 5** is designed to familiarize you with the operation of the **PEBCO®** Dustless Loading Spout.

## 6.0 MAINTENANCE RECOMMENDATIONS

**Section 6** covers recommendations for maintenance procedures. Information is presented on lubrication, rotary limit switch adjustment, internal cone inspection, cable inspection, and outer sleeve replacement. Maintenance specific to SCDLS units is also presented.

## 7.0 WARRANTY

**Section 7** is **PEBCO®**'s Warranty to the purchaser of Dustless Loading/Self-Contained Dustless Loading Spouts.

## 2 PRODUCT OVERVIEW

---

The **PEBCO®** Dustless Loading Spout (DLS) is a device of two or more conical sections that bridges the gap between a load-out controls device such as a cutoff gate, conveyor, etc. and a hopper, truck, railcar or barge. The DLS is retracted to allow the moveable transport device to be positioned and then it is lowered to facilitate dust-free loading of the bulk solid product. Product is dropped into the inlet cone and travels down the cone assembly, out of the outlet cone, and into the container being loaded. As product moves down the spout, dust is contained in the dust sleeve encasing the cone assembly, and routed to a dust collection system through an outlet in the tub.

### 2.1 STANDARD COMPONENTS

The following components can be found on all **PEBCO®** DLS units:

#### DRIVE MOTOR AND GEAR REDUCER

The motor and gear reducer are mounted to the outside of the housing assembly to provide easy access. The motor is powered by a three phase power source and is engaged by a command from the operator. Motor and gear reducer combinations vary depending on the application; see the manufacturer's component data in the associated cut sheet for detailed manufacturer data.

#### DRIVE SHAFT AND LIFT CABLES

The drive shaft is supported by flange bearings mounted on either side of the housing assembly and raises and lowers the spout by way of three lifting cables which run from cable drums on the shaft to the outlet assembly. For lifting cable inspection and replacement, refer to **Section 6.9.1**.

#### ROTARY LIMIT SWITCH

The rotary limit switch is connected to the shaft by a chain drive. The rotary limit switch dictates the limits of travel for the DLS by dropping out the motor contactor to stop the motor when the adjustable cams within the switch reach positions which correspond to the upper and lower limits of travel. These limits can be changed as desired by adjusting the switch; for more information on rotary limit switch adjustment, see **Section 6.7**. Refer to the associated cut sheet for manufacturer data.

#### INLET CONE

The inlet cone is contained within the housing, and connects the spout to the equipment above by way of a sealed flange. Material enters through the inlet cone and is passed down either to the outlet assembly or an intermediate cone assembly.

#### CONE SUPPORT CABLES

The cone support cables ensure that each cone is suspended level and at the correct height. The cable runs from the housing assembly to the outlet assembly with intermediate cones connected to the cable via U-bolt cable clamps. For cone suspension cable inspection and replacement, see **Section 6.9.2**.



## OUTLET ASSEMBLY

The outlet assembly is held at the desired height by the lifting cables, and consists of a housing, outlet cone, a hatch adapter for loading sealed containers or an outlet skirt for loading open containers, along with optional equipment.

## FABRIC REINFORCED DUST SLEEVE AND RINGS

The fabric reinforced dust sleeve serves to contain dust and connects from the housing assembly to the outlet assembly. Depending on the application, it may be constructed from Coverlight, neoprene coated nylon, or silicone coated fiberglass. Reinforcing rings are spaced along the sleeve, allowing it to maintain shape. For dust sleeve replacement, see **Section 6.10**.

## DUST COLLECTOR OUTLET

The dust collector outlet may be located on the side or the top of the housing assembly, and serves to route dust from the spout to a dust collection system.

## 2.2 OPTIONAL COMPONENTS

In addition to the standard components mentioned in **Section 2.1**, PEBCO® DLS units are also available with the following:

### INTERMEDIATE CONE ASSEMBLY

Depending on the length of travel, the DLS unit may contain an intermediate cone assembly between the inlet and outlet cones. Intermediate cones are attached to the cone support cables using U-bolt cable clamps. When the spout is retracted, these cones compactly nest inside one another. When the spout is extended, the cones telescope to direct the product into the container being loaded. For cone inspection and replacement, refer to **Section 6.8**.

### SLACK CABLE SWITCHES

Slack cable switches are mounted inside the housing assembly and are held in a closed position when the cable is taut. When the cable becomes loose due to the outlet assembly hitting an obstruction, the slack cable switch will move to an open position, which will either stop the motor or send a signal to the operator. See the associated cut sheet for manufacturer data.

### AIR VIBRATOR

An air vibrator may be installed on the outlet assembly to assist in material flow. Air vibrators must be connected to filtered, regulated, and lubricated air with pressure not to exceed 80 psi. Air is supplied via a coil hose which stretches between the housing assembly and the outlet assembly. **DO NOT** connect air vibrators to the same air supply as SCDLS headers; vibrator air must be lubricated, while header air must be dry. For more information, see the manufacturer's data provided in the associated cut sheet.

## TILT SWITCH AND JUNCTION BOX

Tilt switches are used to indicate the height of the material or a choked loading condition, and are mounted on a chain beneath the outlet assembly. When the switch is pushed away from the vertical position by the material pile, the switch sends a signal to the operator, indicating the spout should be raised until the switch resets. Tilt switches are available in carbon steel, stainless steel, and PVC, with an optional float ball for liquid applications. For specific manufacturer data, see the associated cut sheet.

## PENDANT CONTROL (WIRED OR UNWIRED)

PEBCO® can provide a pendant control for the unit if desired. Controls are engineered to meet the needs of the customer, and vary in configuration depending on the application. See the associated cut sheet for specific manufacturer data.

## MOTOR BRAKE

Motor brakes are used to assist in stopping of the spout. DLS units without motor breaks rely on friction in the gear reducer to stop the spout. If more precision is required, motor brakes are used so that when the motor is not receiving a signal to operate, the brake engages.

## 2.3 SCDLS SYSTEMS

Unlike standard DLS systems, Self-Contained Dustless Loading System (SCDLS) are manufactured with a dust collection system installed directly onto the housing assembly. This eliminates the need for a stand-alone dust collection system, and also provides an easy way to put material back into the product stream.

During the loading process, the dust filters, which are positioned within the spout, are periodically and automatically purged by air blasts from the diaphragm valves. This forces product collected on the filters back into the product stream and into the vehicle or container being loaded.

In addition to the components of the standard DLS system, the SCDLS contains the following:

### AIR PLENUM

The Air plenum is a sealed chamber located directly above the housing assembly. Air is drawn into the plenum through the filters, and expelled through the exhaust fan. The plenum also contains inspection panels for easy access to the filters for inspection and replacement.

### HEADERS FOR COMPRESSED AIR

The headers on an SCDLS serve as an air reservoir for the diaphragm valves. Air is supplied to the headers through one of the fittings located on each header. Use 70-80 psi of clean dry air to charge the headers.

### DIAPHRAGM VALVES

Diaphragm valves pulse air onto the filters during operation to remove product buildup and force it back into the product stream. The valves are located on top of the plenum to allow for easy access,

and are pulsed automatically by the dust collector timer controller during operation. For more information on diaphragm valves, refer to the manufacturer data in the associated cut sheet. For maintenance, see **Section 6.14.1**.

### **MULTI PLEATED DUST COLLECTION FILTER PACK**

The dust collection filters are mounted between the tub and the plenum and can be reached via the access panels on the plenum. Filters remove product from the airstream before it enters the plenum, allowing air to be routed directly out of the plenum into the atmosphere without further need for processing. Each filter can accommodate a volume flow rate of 500 CFM. Manufacturer data can be found in the associated cut sheet; for filter inspection and replacement, see **Section 6.13**.

### **ENCLOSURE CONTAINING THE DUST COLLECTOR TIMER CONTROLLER**

The dust collector timer controller is located inside an enclosure on the side of the unit. The timer controller regulates the purge sequence by signaling the pilot valve connected to each diaphragm valve, controlling both the time between each purge and the duration of each purge. The controller also monitors the pressure differential across the filters for maintenance purposes. Manufacturer data can be found in the associated cut sheet.

### **SOLENOID DRAIN VALVE**

The drain valve is connected to each header and serves to remove condensation accumulated in the headers. After each purge cycle, the dust collector timer controller opens the drain valve, which evacuates the water from the system. Manufacturer data can be found in the associated cut sheet. For maintenance, see **Section 6.14.3**.

### **EXHAUST FAN**

The exhaust fan is mounted to the top of the plenum and serves to drive air from the spout and the container being loaded through the filters and out into the atmosphere. In some cases, air may be ducted from the outlet of the exhaust fan; however, this is usually not necessary. Do not duct the outlet air unless the system was originally designed with this specification in mind, as ducting the outlet air induces a higher load on the exhaust fan. The volume flow rate is controlled by means of a damper on the outlet of the fan. Use care when adjusting the volume flow rate to ensure that the maximum flow rate for the filters and the maximum load on the exhaust fan motor is not exceeded. See the manufacturer's component data in the associated cut sheet for more information; for exhaust fan burn-in instructions, see **Section 4.3.4**.

## 3 STORAGE RECOMMENDATIONS

---

### 3.1 GENERAL REQUIREMENTS

If **PEBCO®** equipment is to be stored for a period of time longer than three weeks prior to installation, the following procedures are recommended:

- Equipment should be stored in enclosed areas. Indoor storage area should be clean and dry. Storage should be off of the floor, preferably on skids or pallets.
- Storage area should be free from rapid temperature changes. If necessary, an additional heat source should be used.
- Storage area should not subject equipment to vibration.
- All interior and exterior surfaces of the spout must be thoroughly coated with Cosmoline. Any unpainted surfaces, such as shafts, rollers, bearings, and pins should be given special attention to ensure a thorough covering of Cosmoline.
- Storage must be above any possible water or snow line.
- All bearings must be fully charged with grease.
- Periodic inspections should be made, checking the covering, any moisture present, cleanliness and general appearance to ensure the absence of corrosion and the integrity of the Cosmoline coating.
- If outdoor storage is necessary, the equipment should be fully covered with weather-proof material, vented so as not to trap moisture, but drip-proof so the water cannot enter or splash up into it.

### 3.2 ELECTRICAL EQUIPMENT

- All electrical device enclosures must be opened and coated with CRC Stor & Lube.
- All electrical connections (terminations) must be coated with CRC Stor & Lube.
- All electrical openings must be capped or plugged as necessary to be sealed to atmosphere.
- Electrical junction boxes included with the equipment should be opened and any exposed wire and terminations should be coated with CRC Stor & Lube. Open conduit connections should be plugged or capped to atmosphere and the enclosure door should be securely tightened to ensure sealing integrity.

### 3.3 SCDLS SPECIFIC EQUIPMENT

- Headers should be sealed from the environment, and inspected for rust or corrosion prior to installation if stored for a period longer than six months. If rust is found, it must be removed before the unit is installed.
- Filters should be stored in an area protected from pests and excess humidity. Temperature should not exceed 100°F (38°C). Do not stack. Storing filters mounted inside the assembly is acceptable so long as all these conditions are satisfied by the storage area for the assembly.
- Hose assemblies must be removed & capped/plugged.

### 3.4 ADDITIONAL REQUIREMENTS

**Prior to long-term storage, and start-up after storage, please refer to any and all applicable instructions published by individual component manufacturers.**

## 4 GENERAL INSTALLATION

---

### 4.1 RECEIVING INSPECTION

Upon receipt of the equipment, a thorough inspection of the equipment should be made. The following points should be noted:

- Condition of the shipping crate/skid that would indicate rough handling or possible equipment damage
- Condition of the equipment itself; obvious dents, bent flanges, loose or broken accessories, oil leaks, etc.
- Check packing list to see if any parts were shipped loose, and if they are packed with the equipment.

REPORT ANY DAMAGE OR MISSING COMPONENTS TO THE DELIVERING CARRIER.

### 4.2 INSTALLATION WARNING

#### !!! WARNING !!!

Installation requires that the unit be moved between its retracted and extended positions. Before repositioning the unit, ensure that all personnel are standing clear of the unit. After repositioning of the unit, fully isolate the unit from all power sources.

Follow all local fall protection/falling object protection requirements whenever working aloft. Anchor all large equipment that is to be installed BEFORE lifting. If a Loading Spout Positioner system is present, this system should be fully isolated from all power sources before any lifting systems are positioned. Moving the unit while lifting systems are in place may result in equipment damage or tipping of the lifting system.

### 4.3 MOUNTING AND INSTALLATION

PEBCO® Dustless Loading Spouts (DLS) are normally shipped in a nearly retracted position and suspended from a wooden frame. Larger units, however, are often shipped with subassemblies on separate skids. **Section 4.3.1** covers installation for assembled units. For large units, see **Section 4.3.2**.

SCDLS units mount in the same way as DLS units; however, some additional steps will be required. These steps can be found in **Section 4.3.3**.

#### 4.3.1 Installation of Assembled Units

1. Remove the bolts and straps holding the DLS in the shipping frame.

**NOTE:** Do not remove packing or skid until the spout has been bolted in place, with provided bolts, nuts, and lock-washers secure tightly.

2. Check the alignment of the bolt holes on both the mating flange and the support steel to determine if the bolt holes will match correctly with the unit. Do not attempt to correct alignment by drilling through the flange, as this will possibly weaken the flange and result in a poor seal. Check the mating flange for level.
3. Install the appropriate gasket material or sealant on the top flange surface of the housing.
4. Using a fork truck or other appropriate equipment, lift the spout to the mating flange.
5. Install nuts and washers. Use only a high grade hex head bolt with an equal grade of nut, flat and lock washer. Lock washers and/or a thread locking material should be used. Angle supports on top of the housing assembly must be utilized for additional support to the hopper or other rigid steel structure to ensure that the housing assembly is installed securely; the unit CANNOT be supported solely by the flange.
6. The skid and packing can now be removed.
7. Install the dust collection hose/pipe to the side outlet of the housing using an appropriate gasket material. (Not necessary for SCDLS units)
8. Electrical connections to the drive motor, rotary limit switch, and optional equipment can now be made. Refer to the provided wiring diagrams for more information.

**!!! WARNING !!!**

Until the Rotary Limit Switch has been checked to ensure proper adjustment, DO NOT FULLY RETRACT THE SPOUT, as over retracting may cause damage to the unit. PEBCO® DLS systems are shipped extended approximately 4 inches from the fully retracted position to protect against over retracting during installation.

9. Check the motor for correct rotation.
10. Continue to **Section 6.7** for rotary limit switch adjustment.
11. If the DLS contains automatic-raise or level switches, they should be tested by manually tilting the sensing probe. Make sure that this activates the spout motor or relays a signal to the operator.
12. For SCDLS units, continue to **Section 4.3.3**.

**NOTE:** After one week of service, it is recommended that a complete check of all fasteners be made to ensure tightness.

### 4.3.2 Installation of Unassembled Units

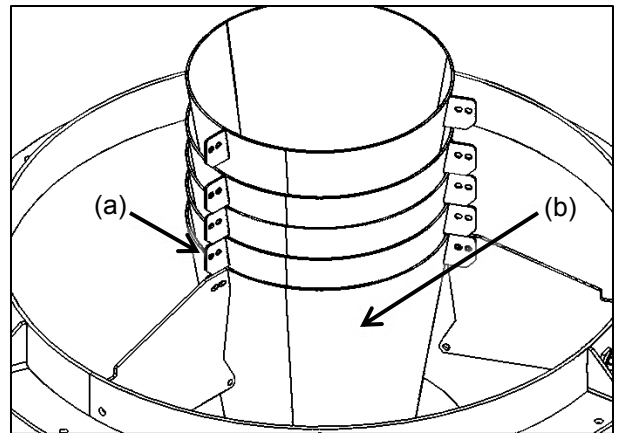
Large DLS units are generally shipped with subassemblies on separate skids as follows:

- Housing assembly, including drive assembly and lift cables wound on single-groove lift pulleys
- Outlet assembly

- Cone assembly, including cone support cable harness
- Outer flexible sleeve
- Miscellaneous parts including: fasteners, cable fittings, and other items as identified on the parts list or packing list.

Installation and assembly of the unit is completed as follows:

1. Remove the bolts and straps holding the DLS in the shipping frame.
2. Check the alignment of the bolt holes on the housing assembly to determine if the bolt holes will match correctly. Do not attempt to correct alignment by drilling through the flange, as this will possibly weaken the flange and result in a poor seal. Check the mating flange for level.
3. Install the appropriate gasket material or sealant on the top flange surface of the housing assembly.
4. Using a fork truck or other appropriate equipment, lift the housing assembly to the mating flange.
5. Install nuts and washers. Use only a high grade hex head bolt with an equal grade of nut, flat and lock washer. Lock washers and/or a thread locking material should be used. Angle supports on top of the housing assembly must be utilized for additional support to the hopper or other rigid steel structure to ensure that the housing assembly is installed securely; the unit CANNOT be supported solely by the flange.
6. Install the dust collection hose/pipe to the side outlet of the housing using an appropriate gasket material. (Not necessary for SCDLS units)
7. Position the outlet assembly beneath the housing assembly at the published extended length. The junction box for the product sensor probes, if provided, should be aligned with the junction box for that purpose on the housing assembly. Align the lift cable attachment points on discharge with the sheaves in the housing assembly.
8. Place the cone assembly in the discharge cone as shown in **Figure 1**, aligning the cone support tabs with tabs on discharge cone. Attach the cone support cables to the discharge cone.



**Figure 1: Cone Assembly Placement**  
(a) Cone Support Tabs  
(b) Discharge Cone

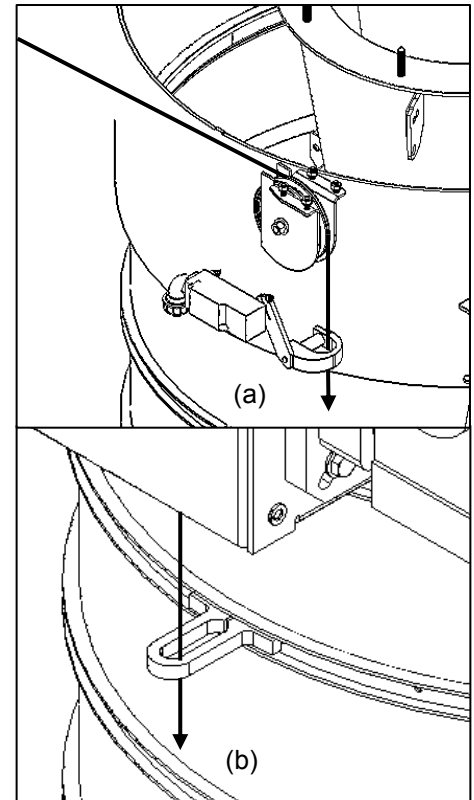


9. Place the flexible sleeve over the cone stack and onto outlet assembly. Do not connect to discharge at this time. The sleeve should be aligned such that the cable guides on the sleeve are aligned with the lift cable attachment points on the outlet assembly.
10. Electrical connections can now be made to the drive motor, rotary limit switch, and optional equipment. Refer to the provided wiring diagrams for more information.
  - a. If the pre-wire option has been purchased, all components on a sub-assembly, with the exception of the motor and brake, are wired to a common junction box on the sub-assembly. Components located on the outlet assembly are to be connected to appropriate terminals in the junction box on the housing assembly. This is to be done via the multiple-conductor cable festoon on the flexible sleeve or the cable reel provided for this purpose. All other control terminations are made in the junction box located on the housing assembly.
  - b. If the pre-wire option has not been purchased, the customer or his representative is responsible for terminations at the various components, according to the drawing provided. Connections for the tilt switch are located within a small terminal box located on the outlet assembly. The rotary limit switch and slack cable limit switch are located on the housing assembly, and should be wired through conduit suitable for the expected environment. The motor and brake should be wired through a separate conduit, as these are high-voltage, three-phase components.
11. Check the motor for correct rotation.

**!!! WARNING !!!**

Until the Rotary Limit Switch has been checked to ensure proper adjustment, DO NOT FULLY RETRACT THE SPOUT, as over retracting may cause damage to the unit.

12. Lower the lift cables a minimum of 6 inches past the attachment points on the outlet assembly, threading each cable as seen in **Figure 2**: (a) through the slack cable limit switch arm (if provided), and (b) through the cable guides on the flexible sleeve.
13. Attach the lift cables to the outlet assembly using the lifting eyebolts, making necessary adjustments to ensure the discharge will hang level.
14. Continue to **Section 6.7** for rotary limit switch adjustment before proceeding to step 15.
15. Using the drive assembly, raise the outlet assembly until the cone support cable harness can be connected to the housing assembly using the quick-links provided. Lower the discharge to



**Figure 2: Cable Threading**  
(a) Slack Cable Limit Switch  
(b) Cable Guides

the fully extended position to ensure the cone assembly will hang straight.

16. Raise the outlet assembly until the outer flexible sleeve can be connected to the housing assembly. Insert the top ring into the tub on the housing assembly and tighten the retaining bolts.

**NOTE:** It may be necessary to push the seal material in with a flathead screwdriver or similar tool, as it has a tendency to bulge out of the tub.

17. Once the sleeve is secure, lower the assembly to the fully extended position. Connect the sleeve to the outlet assembly, making sure there are no twists.
18. Raise and lower the spout several times to test the operation of the spout. If the outer sleeve develops a twist, loosen the lower connection and straighten the sleeve while extended. Make any necessary adjustments to the lift cable to level the outlet assembly.
19. If the DLS contains automatic-raise or level switches, they should be tested by manually tilting the sensing probe. Make sure that this activates the spout motor or relays a signal to the operator.
20. For SCDLS units, continue to **Section 4.3.3**.

**NOTE:** After one week of service, it is recommended that a complete check of all fasteners be made to ensure tightness.

### 4.3.3 Installation of Dust Collection Systems on SCDLS Units

1. Check all air tubing for any signs of damage, and tool check each connection to ensure tightness. Connections are tightened at the factory, but can become loose during shipping.
2. Connect the Dust Collector Timer Controller to power according to the provided wiring diagrams.
3. The air supplied to the dust collection system should be clean and dry, as moisture and contaminants can severely damage the filters and valves.
4. Connect the air supply to the header. Headers should be pressurized at 70 to 80 psi; over-pressurizing could cause the filters to fail. It is recommended that a cutoff valve be installed immediately before the header for maintenance purposes.

**NOTE:** Although each header contains an inlet for compressed air, it is only necessary to connect the air supply to one header

### 4.3.4 SCDLS Fan Motor Burn-in Instructions

Before beginning the burn-in procedure, review the electrical connections to make sure the unit has been wired properly. Check each connection for snugness and placement, and ensure that overloads are properly set.

Burn-in should take place with the damper closed; this will ensure minimum amp draw and reduce the risk of damaged equipment. If for any reason it is required that the damper be opened, **DO NOT** open the damper more than 25% of the way from the fully closed position. **Fully opening the damper will cause overload and may damage the system.**

Once burn in is complete, the damper may be adjusted as necessary to obtain the desired volume flow rate by measuring the static pressure at the outlet and referencing that measurement to the fan curve provided in the manufacturer's component data. Use care when adjusting the volume flow rate to ensure that the maximum flow rate for the filters and the maximum load on the exhaust fan motor is not exceeded.

## 5 OPERATION

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### !!! WARNING !!!

Before beginning a loading operation, make sure the area around the spout is clear of personnel. As direct exposure to the product stream can result in seriously injury or death.

1. After the vehicle/container has been positioned with its hatch directly below the spout, open the vehicle/container hatch.
2. Once the hatch has been opened, begin lowering the loading spout to the vehicle or container opening.
3. The dust extractor should be turned on at this point.
4. Continue to lower the outlet assembly until it is firmly seated in the vehicle/container hatch.
5. Start the product feed. The vehicle or container should be properly filled with little or no visible dust.
6. When the vehicle is full, raise the spout completely and turn off the dust extractor. This completes the loading cycle.

## 6 MAINTENANCE RECOMMENDATIONS

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### 6.1 MAINTENANCE PROGRAM IMPORTANCE

An inspection and maintenance program should be established to ensure the successful operation of the equipment during its working life.

One of the most important aspects of any maintenance program lies in establishing a good set of operating records. Daily log sheets should be set up to record all important operating parameters of the equipment. Inspection at predetermined intervals is essential. The frequency of inspections may vary with operating conditions and the environment of operation. Complete records will also indicate spare parts used and on-hand, and the historical details of any maintenance or overhaul which takes place.

The purpose of a good maintenance program is to achieve maximum operating performance while holding down maintenance costs.

### 6.2 WEAR PARTS

Parts exposed to high frictional forces, whether due to the sliding of two parts against each other, or due to exposure to the product flow, are expected to wear and may need to be replaced. **PEBCO®** does not consider the wearing of Seals, Cones, Lift Cables, Cone Suspension Cables, Dust Sleeves or SCDLS Filters due to friction to be a defect as covered under the product warranty, and replacement of said parts is considered to be the responsibility of the purchaser.

### 6.3 MAINTENANCE SCHEDULE

Scheduled inspection of equipment and active preventive maintenance are essential for optimum performance and long equipment life. This section lists suggested schedules for maintenance. However, actual service conditions and environment greatly affect equipment reliability and such schedules should be adjusted as necessary to suit the specific requirements of the installation. Additional maintenance may be required for components not manufactured by **PEBCO®**; see the manufacturer's component data for manufacturer recommendations.

### 6.3.1 Suggested Maintenance Schedule

Weekly			Monthly			Quarterly			Yearly		
	Visually Check for Loose Hardware	<input type="checkbox"/>		Grease Flange Bearings	<input type="checkbox"/>		Tool Check for Loose Hardware	<input type="checkbox"/>		Check all Wiring for Fraying or Damage	<input type="checkbox"/>
	Check Air Pressure ( Air Vibrator)	<input type="checkbox"/>		Tool Check Air Vibrator Mounting Bolts	<input type="checkbox"/>		Check Gear Reducer Oil Level	<input type="checkbox"/>		Inspect Mounting Bolts	<input type="checkbox"/>
		<input type="checkbox"/>			<input type="checkbox"/>		Check Chains	<input type="checkbox"/>			<input type="checkbox"/>
		<input type="checkbox"/>			<input type="checkbox"/>		Grease Drive Bearings	<input type="checkbox"/>			<input type="checkbox"/>
		<input type="checkbox"/>			<input type="checkbox"/>		Check Electric Motors	<input type="checkbox"/>			<input type="checkbox"/>
		<input type="checkbox"/>			<input type="checkbox"/>		Check Limit Switch(es)	<input type="checkbox"/>			<input type="checkbox"/>

### 6.3.2 Spare Part Installation Log

Date	Part	Qty.	Comments

## 6.4 SAFETY PRECAUTIONS

### !!! WARNING !!!

Before conducting any maintenance on or around the system, it should be fully isolated from all power sources. Failure to do so may result in injury or death.

Follow all local fall protection/falling object protection requirements whenever working aloft. Anchor all large equipment that is to be removed/installed BEFORE removing/lifting. If a Loading Spout

Positioner system is present, this system should be fully isolated from all power sources before any lifting systems are positioned. Moving the unit while lifting systems are in place may result in equipment damage or tipping of the lifting system.

## 6.5 GENERAL INSPECTION

In order to ensure maximum operating efficiency and to prevent excessive down-time and costly replacements, it is recommended that an inspection of the systems and sub-systems of the unit be conducted every 90 days.

- Electrical motors, and limit switches, both rotating and/or lever type, should be checked and tested to ensure they are in good working order.
- Drive coupling, shaft keys, lifting pulleys, and set screws should be tool checked for loose connections.
- Lifting cables should be inspected for fraying of cable, which could cause damage to equipment or injury to operating personnel during loading.

## 6.6 LUBRICATION

General recommendation is for lubrication:

### 6.6.1 Flange Bearings

Flange bearing(s) that support the drive shaft(s) and idler shaft(s) should be greased every 100 hours of operation using NLGI #2 Lithium based grease, if the particular bearing has a grease fitting.

### 6.6.2 Gear reducer

Gear reducer lubrication level must be visually inspected every 90 days on non-sealed units to ensure that proper level is maintained. Gear reducers are filled to the proper level at the factory with AGMA No. 7 compounded oil. After installation of the breather plug, unit is ready for use. Before installing the breather plug, refer to instruction tag and determine the proper position according to reducer mounting.

Consult the component data sheets for additional recommendations on gear reducer lubrication from the manufacturer.

### 6.6.3 Drive Motor

Refer to the manufacturer's recommendations listed in the specific component data sheet(s).

### 6.6.4 Drive Bearings

Drive bearings should be lubricated with NLGI #2 Lithium based grease every 90 days.

### 6.6.5 Lifting Cables

Lifting cable transfer sheaves located under housing assembly have non-lubricated bearings. These bearings should remain dry and are not to be lubricated.

## 6.7 ROTARY LIMIT SWITCH ADJUSTMENT

Rotary limit switches are preset at the factory; however, they can become misaligned during shipping or after long periods of operation and should be checked during installation and periodically thereafter.

1. Remove the cover on the rotary limit switch, so that the limit switch cams can be observed.
2. With a person observing the limit switch cams, jog the motor to raise the DLS.
3. Raise the unit until the published retract height for the unit is reached. Refer to the customer certified drawing accompanying this manual.
4. At this point, one of the limit switch cams should have actuated one of the micro switches or be just ready to actuate:
  - a. If a micro switch has been actuated, this action should have stopped the drive motor. **If not, recheck the limit switch circuitry to determine if it is properly wired to the motor starter.**
  - b. If a micro switch has **not** been actuated but is just about to, continue the operation of the drive unit until the sequence described in (a) occurs. If this causes the retracted height of the DLS to be different than specified on the certified drawing, this condition is acceptable if the difference in height is no more than plus or minus 1-1/2 inches.
  - c. If at the retracted position a limit switch cam is not near the activation point - the particular limit point must be reset. See instructions inside cover of switch enclosures.
5. Lower the DLS assembly to its full extended length listed on the customer certified drawing accompanying this manual.
6. At this point, observe and confirm the following:
  - a. The outlet assembly is suspended in a level position. (If not, adjust the lifting eyebolts on the outlet assembly).
  - b. The dust sleeve is suspended uniformly with no twists in the fabric. (Also check for hidden tears.)
  - c. The **other** rotary limit switch either stopped the drive motor at this position or the observed cam is just ready to actuate.
7. It is important that the rotary limit switch stop the DLS in the lower position **just before the lift cables become slack.** This condition is preset at the factory, but may have shifted during transit or operation.



8. If the rotary limit switch stopped the drive unit in step 6 then the checkout of the limit switch is complete.
9. If the limit switch cam has not quite activated at this point, continue to lower the DLS until the cam actuates the lower level switch.
10. If this point occurs within 1-1/2 inches of the published extension height on the customer certified drawing and the lift cables are still in tension, no further adjustment is necessary.
11. Raise and lower the spout several times to ensure it is performing properly and stopping at its upper and lower rotary limit switch set points.
12. If the lift cables are slack or the extended position is lower than desired, the switch point must be reset.

## 6.8 INTERNAL CONE INSPECTION AND REPLACEMENT

Internal cones should be inspected to ensure that product flow into the vehicle/container, or air flow up through the spout, is not restricted due to damaged components. If bent, damaged, or worn components are discovered, these components can be easily and economically replaced.

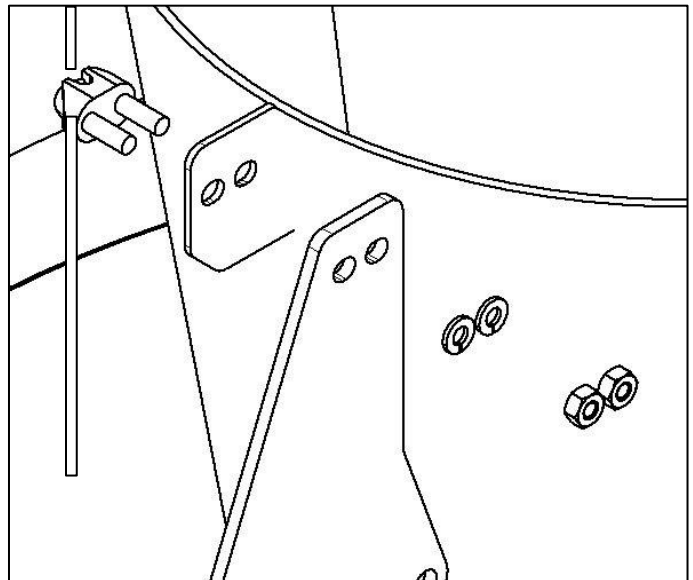
Special attention should be paid when loading hygroscopic or sticky material through loading spout. Periodically check internal cones for product build-up; if build-up is found, strike or scrape each cone to eliminate it.

### 6.8.1 Intermediate Cone Replacement/Inspection (Lower Half)

#### !!! WARNING !!!

Prior to performing cone inspection or replacement, the system must be isolated from all external power sources. If work is being done on the cone assembly and the drive motor engages, it could result in personal injury or death.

1. With the unit in its full extended position, loosen the bolts on the lower end of the dust sleeve.
2. Raise the sleeve up as far as necessary to inspect the lower cones. Secure the sleeve in a raised position by tying it off or other appropriate means.
3. To replace a cone, disconnect the U-bolt cable clamps from the cone (**Figure 3**) and remove the cone. Leave the clamps attached to the cables.



**Figure 3:** Cone U-bolt Cable Clamps

4. Attach the new cone to the cable clamps. Apply Loctite 243 (567 for stainless steel applications) to the threads before tightening the nuts.
5. Lower the dust sleeve into position and replace and tighten the bolts, applying Loctite 243 (567 for stainless steel applications).

### 6.8.2 Intermediate Cone Replacement/Inspection (Upper Half)

#### !!! WARNING !!!

This procedure requires that the unit be moved between its retracted and extended positions. Before repositioning the unit, ensure that all personnel are standing clear of the unit. After repositioning of the unit, fully isolate the unit from all power sources.

Take all appropriate precautions for working on equipment suspended from overhead. Failure to take prudent safety measures can result in serious injury or death.

On dustless loading spout units with lengths greater than 8 feet, the dust sleeve becomes quite heavy. Special handling consideration must be given to the dust sleeve when performing this maintenance.

1. Raise the spout to its retracted (full-up) position. Loosen the bolts retaining the dust sleeve.

**NOTE:** AT THIS POINT THE DUST SLEEVE AND STIFFENING RINGS WILL DROP. IT IS IMPORTANT THAT DUE CONSIDERATION BE GIVEN TO THIS FOR SAFETY!!

2. Lower the spout to expose the cones in the upper section of the DLS.
3. To replace a cone, disconnect the U-bolt cable clamps from the cone(s) and remove the cone(s). Leave the clamps attached to the cables.
4. Attach the new cone to the cable clamps. Apply Loctite 243 (567 for stainless steel applications) to the threads before tightening the nuts.
5. Raise the outlet assembly until the sleeve can be connected to the housing assembly. Insert the top ring into the tub on the housing assembly. Apply Loctite 243 (567 for stainless steel applications) to the retaining bolts and tighten.

**NOTE:** It may be necessary to push the seal material in with a flathead screwdriver or similar tool, as it has a tendency to bulge out of the tub.

## 6.9 CABLE INSPECTION AND REPLACEMENT

An inspection of the lift cables and cone support cables should take place every 90 days to minimize maintenance costs and ensure safe operation.

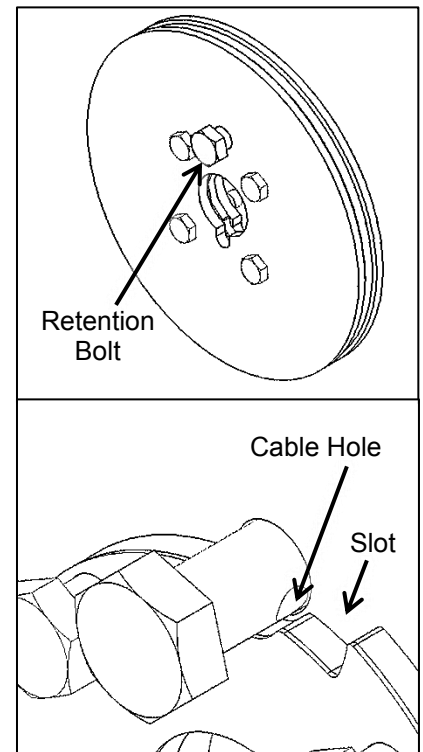
### 6.9.1 Lift Cable Inspection and Replacement

#### !!! WARNING !!!

This procedure requires that the unit be moved between its retracted and extended positions. Before repositioning the unit, ensure that all personnel are standing clear of the unit. After repositioning of the unit, fully isolate the unit from all power sources.

Take all appropriate precautions for working on equipment suspended from overhead. Failure to take prudent safety measures can result in serious injury or death.

1. Lower the spout to the extended position.
2. Visually inspect the entire length of the cable, including the portion of the cable remaining inside the housing assembly. If any signs of corrosion or fraying are present, the cable must be replaced.
3. To replace the cable, lift the spout so that a work platform can be placed under the outlet assembly.
4. Lower the outlet assembly onto the platform.
5. Disconnect the cable from the outlet assembly by unscrewing the lifting eyebolt.
6. Remove the cable from the drum by loosening the retention bolt on the drum (**Figure 4**)
7. Thread the new cable through the turning sheave (**Figure 2**).
8. Attach the cable to the drum by threading it through the hole in the retention bolt (**Figure 4**). The loose end of the cable should be short enough to fit completely inside the slot.
9. Tighten the retention bolt.
10. Tightly wrap the cable around the drum twice and thread the cable through the cable guides
11. Connect the cable to the outlet assembly using the lifting eyebolt.
12. Raise the spout so that the outlet no longer rests on the work platform. Adjust the lifting eyebolt until the outlet assembly sits level.



**Figure 4: Cable Retention Bolt**

## 6.9.2 Cone Support Cable Inspection and Replacement

### !!! WARNING !!!

This procedure requires that the unit be moved between its retracted and extended positions. Before repositioning the unit, ensure that all personnel are standing clear of the unit. After repositioning of the unit, fully isolate the unit from all power sources.

Take all appropriate precautions for working on equipment suspended from overhead. Failure to take prudent safety measures can result in serious injury or death.

1. In the retracted position, loosen the sleeve retaining bolts at the top end of the sleeve, and remove the top of the sleeve from the tub.

### !!! WARNING !!!

On dustless loading spout units with lengths greater than 8 feet, the dust sleeve becomes quite heavy. Special handling consideration must be given to the dust sleeve when performing this maintenance.

2. Lower the spout to the full extended position.
3. Inspect the full length of each cable for signs of corrosion or fraying. If any corrosion or fraying is found, the cable must be replaced.
4. To replace the cable, raise the spout to a position about 12 inches from fully retracted, and disconnect cone support cables from the attachment points inside the tub. Allow the cones to nest within the outlet assembly.
5. Lower the outlet assembly to a position that allows easy access to the cone assembly.
6. Disconnect the cable from the outlet assembly.
7. Mark the cable at each U-bolt cable clamp, and remove the clamps from the cable. (See **Figure 3.**)
8. Transfer the marks from the old cable to the new cable.
9. Attach the new cable to the outlet assembly.
10. Attach each cone to the cable using the U-bolt cable clamps and the marks transferred from the old cable, applying Loctite 243 (567 for stainless steel applications).
11. Lift the outlet assembly to a position at which the cables can be reattached to the housing assembly, and reconnect the cables.
12. Lower and raise the outlet assembly, observing the cones. Each cone should nest within the next without hanging or skewing. Each cone should suspend in a level position. If this is not the case, adjust the cones by repositioning the U-bolt cable clamps.
13. Once each cone has been fully adjusted, fully retract the spout.
14. Push the top of the sleeve back into the tub and tighten the retaining bolts.

## 6.10 DUST SLEEVE REPLACEMENT

Dust sleeves on DLS units do wear out over time and must be replaced. Use the following procedure to replace the dust sleeve whenever holes or tears become evident.

### !!! WARNING !!!

This procedure requires that the unit be moved between its retracted and extended positions. Before repositioning the unit, ensure that all personnel are standing clear of the unit. After repositioning of the unit, fully isolate the unit from all power sources.

Take all appropriate precautions for working on equipment suspended from overhead. Failure to take prudent safety measures can result in serious injury or death.

1. In the retracted position, loosen the sleeve retaining bolts at the top end of the sleeve, and remove the top of the sleeve from the tub.

### !!! WARNING !!!

On dustless loading spout units with lengths greater than 8 feet, the dust sleeve becomes quite heavy. Special handling consideration must be given to the dust sleeve when performing this maintenance.

2. Lower the spout about 12 inches and disconnect the three cone support cables from the attachment points inside the tub. Allow the cones to nest within the outlet assembly.
3. Lower the spout until it rests on a work platform or some type of support, approximately halfway through its travel. Do not work on the spout while the weight of the unit is supported on the three lift cables. Also, do not lower the spout to its full extended position while making these changes.
4. At this time, disconnect the three outside lift cables from the outlet assembly. This will allow the outlet assembly, stacking cones, and outer sleeve to be lowered without unbolting the housing assembly.
5. Loosen the sleeve retaining bolts at the bottom of the sleeve, and lift the sleeve off the spout.
6. Lift the new sleeve over the cone stack, and seat it in the outlet assembly. Align the sleeve with the spout lifting cables such that the bolts will capture the cables without severe rubbing. Do not tighten the lower sleeve retaining bolts at this time.
7. Attach the lifting cables to the outlet assembly.
8. Raise the spout to within 12 inches of the full-up position, and reconnect the cone support cables.
9. Install the top ring of the sleeve inside the tub. Tighten the upper sleeve retaining bolts, applying Loctite 243 (567 for stainless steel applications).

10. Lower the spout to the extended position, and verify the sleeve is straight. It is particularly important that the sleeve have no twists. Tighten the lower sleeve retaining bolts, applying Loctite 243 (567 for stainless steel applications).

## 6.11 SHORTENING OF TRAVEL

### !!! WARNING !!!

This procedure requires that the unit be moved between its retracted and extended positions. Before repositioning the unit, ensure that all personnel are standing clear of the unit. After repositioning of the unit, fully isolate the unit from all power sources.

Take all appropriate precautions for working on equipment suspended from overhead. Failure to take prudent safety measures can result in serious injury or death.

**GENERAL NOTE:** Typically, removing each cone decreases the retracted height by 2 inches and reduces the extended height by 14 inches; however, this is not true of all models. Refer to the provided drawings for detailed information.

1. Raise the spout to its retracted position. Loosen the screws that hold the outer sleeve assembly into the upper housing assembly. Disconnect the sleeve from the housing assembly by loosening the retaining bolts and let it rest on the outlet assembly.

### !!! WARNING !!!

On dustless loading spout units with lengths greater than 8 feet, the dust sleeve becomes quite heavy. Special handling consideration must be given to the dust sleeve when performing this maintenance.

2. Reach inside the housing assembly and remove the three cone support cables by disconnecting the cone shackle from the lug. This will allow the cones to rest on the outlet assembly.
3. Lower the spout until it rests on a work platform or some type of support, approximately halfway through its travel. Do not work on the spout while the weight of the unit is supported on the three lift cables. Also, do not lower the spout to its full extended position while making these changes.
4. At this time, disconnect the three outside lift cables from the outlet assembly. This will allow the outlet assembly, stacking cones, and outer sleeve to be lowered without unbolting the housing assembly.
5. Remove the stacking cone assembly from the outlet assembly by loosening the cable clamps that hold the cone support cables to the outlet assembly. Be sure to make a note of how much cable is extended past the last stacking cone tab to the outlet cone. This is important so that when you start removing cones and cutting cables, you have enough left over to reattach to the outlet cone.
6. Remove the required number of stacking cones from the bottom of the stack to get the desired travel.
7. The outer sleeve must also be shortened. To do this, loosen the screws that hold the outer sleeve assembly into the outlet assembly. Remove the sleeve from the outlet assembly noting its orientation. Cut off two sections from the bottom for every cone that is removed. For example, if you removed one cone, you would stretch the outer sleeve assembly and cut the sleeve at the

second ring up from the bottom of the outer sleeve assembly. **IT IS IMPORTANT TO CUT FROM THE BOTTOM UP!** After cutting, there should always be a ring at the end of the sleeve.

8. Place the outer sleeve assembly into the outlet assembly. Do not tighten any attachment bolts at this time.
9. Place the stacking cone assembly back into the outlet assembly and attach the lifting cables to the outlet assembly.
10. Raise the assembly up into a position where you can reattach the cone support cables to the lug at the top of the inlet. Lower the spout until the cones hang freely, and attach the cone support cables to the outlet assembly.
11. Raise the spout until the top of the sleeve can be attached to the inlet assembly. Once attached, lower the spout until the sleeve hangs freely. When the sleeve is straight (no twists), attach the sleeve to the outlet assembly.
12. After everything is reassembled, check to see if the outlet assembly is level. This can be adjusted by using the lifting eyebolts.
13. Readjust the rotary limit switch full-up/full-down positions as needed. (Refer to **Section 6.7** for rotary limit switch adjustment.)

## 6.12 MOUNTING BOLT INSPECTION

Check the mounting bolts. Replace and/or tighten any loose or missing bolts. Use the same quality of bolts used in installation. This should be done annually.

## 6.13 SCDLS FILTER INSPECTION AND REPLACEMENT

Filters on SCDLS units should be inspected monthly to insure they are in good working condition. Filters should be replaced when the static pressure as measured by the Dust Collector Timer Controller exceeds 4 in (w.c.). The timer controller is contained within an enclosure on the unit. (Some systems may be configured such that the Dust Collector Timer Controller is connected to a computer terminal. If this is the case, the pressure can be read directly from the terminal.) So long as the pressure module is installed, the unit will display the current pressure by default; if this is not the case, see the manufacturer's data.

### !!! WARNING !!!

Prior to performing any maintenance inside the unit, the system must be isolated from all external power sources. If work is being done on the system and the drive motor engages, it could result in personal injury or death.

If the static pressure exceeds 4 in (w.c.), the filters can be replaced by removing the access panels on the plenum (**Figure 5**).

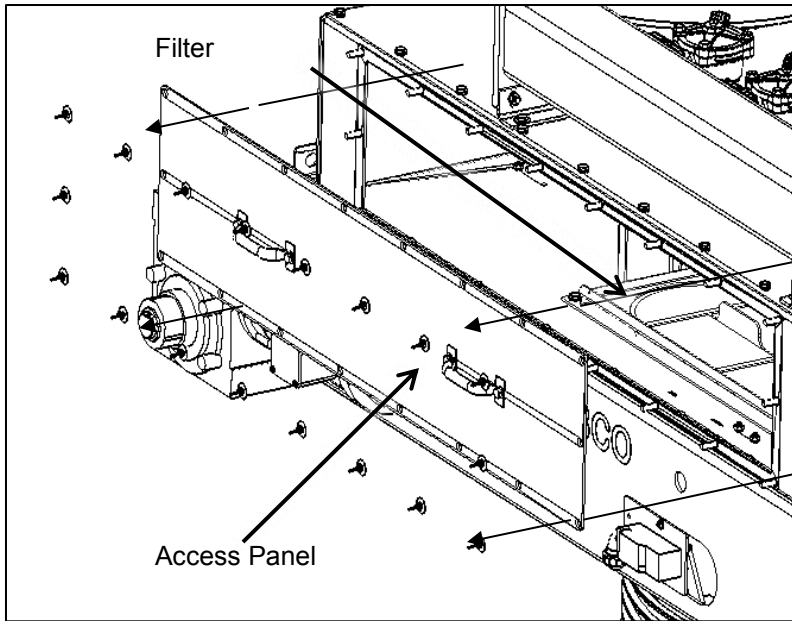


Figure 5: Filter Access

## 6.14 SCDLS VALVE INSPECTION

Diaphragm, pilot, and drain valves should be inspected annually to ensure maximum operating life of the valves and to minimize maintenance costs.

### !!! WARNING !!!

Take all appropriate precautions for working on equipment suspended from overhead. Failure to take prudent safety measures can result in serious injury or death.

### 6.14.1 Diaphragm Valve Inspection

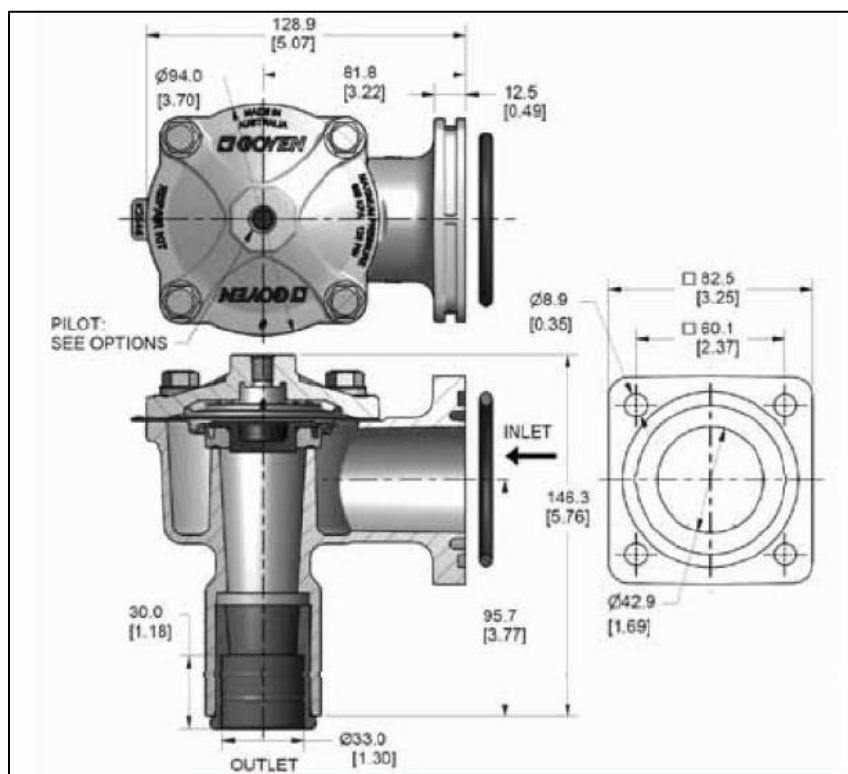
1. Unbolt the diaphragm valve from the header and remove the valve from the SCDLS by sliding it up off the blow tube.
2. Open the valve casing by removing the bolts from the top of the valve.
3. Look for signs of moisture in the valve, which could indicate that the drain valve is faulty or that the supply air is not being properly conditioned. The presence of moisture can drastically reduce performance and life of the diaphragm valves, filters, and headers.
4. Visually inspect all interior surfaces of the valve and clean using a brush or damp cloth. Remove any remaining debris using compressed air.
5. Inspect the diaphragm. If torn, punctured, or worn, it should be replaced. (For replacement parts contact **PEBCO®** at (800)707-3226).
6. Inspect the inlet and outlet seals and replace if necessary.
7. Reassemble the valve.



8. Slide the valve back onto the blow tube.

**NOTE:** Insert the inlet seal into the diaphragm valve BEFORE sliding the valve into position, as the narrow clearance between the inlet and the header will make this difficult to do after the valve has been positioned.

9. Bolt the valve onto the header, reconnecting the tubing from the pilot.
10. After each valve has been inspected and reinstalled, reconnect the electrical and air supplies.



**Figure 6:** Diaphragm Valve Cutaway. (Illustrative purposes only. Goyen model RCAC25FS4 depicted, if different model is installed, see the manufacturer's component data in the associated cut sheet for manufacturer details.)

#### 6.14.2 Pilot Valve Inspection

1. Disconnect the unit from all air and electrical sources.
2. Purge the remaining air from the headers. This can be done by activating the solenoid drain valve attached to the headers.
3. Remove the valve from its housing by removing the screws from the valve.
4. Look for signs of moisture in the valve, which could indicate that the drain valve is faulty or that the supply air is not being properly conditioned. The presence of

moisture can drastically reduce performance and life of the diaphragm valves, filters, and headers.

5. Visually inspect all interior surfaces of the valve and clean using a brush or damp cloth. Remove any remaining debris using compressed air.
6. Inspect the internal workings of the valve; if any damaged or worn components are found, they should be replaced. (For replacement parts contact **PEBCO®** at 1 (800) 707-3226)
7. Reassemble the valve.
8. Inspect the air tubing and electrical wiring connected to the valve. If any damage or wear is found, replace the tubing/wiring.
9. Once all valves have been inspected, reconnect power and charge the headers with 70-80 psi of air.

### 6.14.3 Drain Valve Inspection

1. Disconnect the unit from all air and electrical sources.
2. Purge the remaining air from the headers by activating the drain valve.
3. Disconnect all tubing and electrical connections
4. Remove the valve and inspect all interior surfaces of the valve. Clean using a brush or damp cloth, and remove any remaining debris using compressed air.
5. Inspect the internal workings of the valve; if any damaged or worn components are found, the valve should be replaced. (For replacement parts contact **PEBCO®** at 1 (800) 707-3226)
6. Inspect the air tubing and electrical wiring connected to the valve. If any damage or wear is found, replace the tubing/wiring.
7. Reconnect the valve.
8. Reconnect power and charge the headers with 70-80 psi of air.

## 6.15 TROUBLESHOOTING

Spout discharges slowly or does not discharge:

- Gate/conveyor above the spout is not operating properly
- Product buildup in the cones
- Cones misaligned
- Damaged cones

Spout does not extend:

- Motor not connected to power
- Wiring frayed or loose
- Lower limit of the rotary limit switch set too high
- Slack cable switch misaligned (should be held closed by the cable)
- Rotary limit switch not operational
- Motor not operational

Spout does not retract:

- Motor not connected to power
- Wiring frayed or loose
- Upper limit of the rotary limit switch set too low
- Rotary limit switch not operational
- Motor not operational

Spout over extends:

- Lower limit of the rotary limit switch set too low
- Rotary limit switch not operational
- Motor break not operational

Dust in exhaust (SCDLS):

- Torn filters
- Worn inlet cone

Dust coming from the outlet (SCDLS):

- Fan dampener improperly adjusted
- Clogged filters
- Fan not operating correctly
- Dust Collector Timer Control not receiving power
- Dust Collector Timer Control improperly set
- Dust Collector Timer Control not operational

- Wiring frayed or loose
- Damaged or loose air hose
- Headers not properly charged with air (should be at 70-80 psi)
- Diaphragm valves damaged or incorrectly connected
- Pilot valves damaged or incorrectly connected

## 6.16 HYDRAULIC SYSTEMS

Refer to manufacturer's data sheets on items furnished on this order.

If Hydraulic Power Unit is supplied on this order by **PEBCO®**, refer to the Hydraulic System Manual for detailed operation.

## 7 WARRANTY

---

### WARRANTY: PEBCO® DUSTLESS LOADING/SELF-CONTAINED DUSTLESS LOADING SPOUTS

#### WARRANTY

**PEBCO®** warrants to purchaser, upon the terms set forth, that the equipment purchased, so far as the same is of **PEBCO®**'s manufacture, is free from defects in material and workmanship under normal use and service for a period of twelve (12) months from the date of shipment. All equipment, including motors, manufactured by others, is warranted solely and exclusively by their manufacturers and not by **PEBCO®**, and **PEBCO®** hereby assigns to purchaser without recourse to **PEBCO®** such warranty as is given by the manufacturer.

#### TERMS

**PEBCO®**'s obligation under this warranty is limited to and shall be fully discharged by **PEBCO®** repairing or at its option replacing f.o.b. point of manufacturer any part which is shown to **PEBCO®**'s satisfaction to have been defective as to material or workmanship, provided that written notice of defect is delivered to **PEBCO®**'s office in Paducah, Kentucky, within sixty (60) days after defect is discovered, and in no event more than twelve (12) months and sixty (60) days after shipment.

#### PURCHASER'S ACTS VOIDING WARRANTY

The warranty furnished by **PEBCO®** herein will be rendered void by improper erection or installation, if executed by other than **PEBCO®**, misuse, unauthorized alteration, substitutions, repairs or modifications, neglect or accident, or damage to the equipment caused by improper storage, abrasion, corrosion, and/or operation outside the rated load limitations for use of the equipment. **PEBCO®** shall not be liable for any repairs, replacements or adjustments to the equipment or any cost of labor performed by the purchaser or others without **PEBCO®**'s prior written approval.

#### EXCLUSION OF ALL OTHER WARRANTIES AND LIMITATION OF CONSEQUENTIAL AND INCIDENTAL DAMAGES.

1. THE WARRANTY FURNISHED BY **PEBCO®** AS EXPRESSLY INCLUDED HEREIN IS IN LIEU OF ANY OTHER WARRANTIES OR GUARANTIES EXPRESSED OR IMPLIED. **PEBCO®** MAKES NO OTHER WARRANTY OR REPRESENTATION OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF DESIGN, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED.
2. IN NO EVENT, BE IT DUE TO A BREACH OF WARRANTY OR ANY OTHER CAUSE ARISING OUT OF PERFORMANCE OR NONPERFORMANCE OF THIS PROPOSAL OR CONTRACT, SHALL **PEBCO®** BE LIABLE FOR (1) CONSEQUENTIAL OR INDIRECT LOSS OR DAMAGE INCLUDING BUT NOT LIMITED TO LOSS OF PROFITS, COSTS TO PURCHASE SUBSTITUTE POWER, PLANT DOWNTIME, PRODUCTION, INCREASED COSTS OF OPERATION, OR SPOILAGE OF MATERIAL, OR (2) LOSS OR DAMAGE ARISING OUT OF THE NEGLIGENCE OF THE PURCHASER, ITS EMPLOYEES, AGENTS, ENGINEERS OR ARCHITECT.

## 8 COMPONENTS

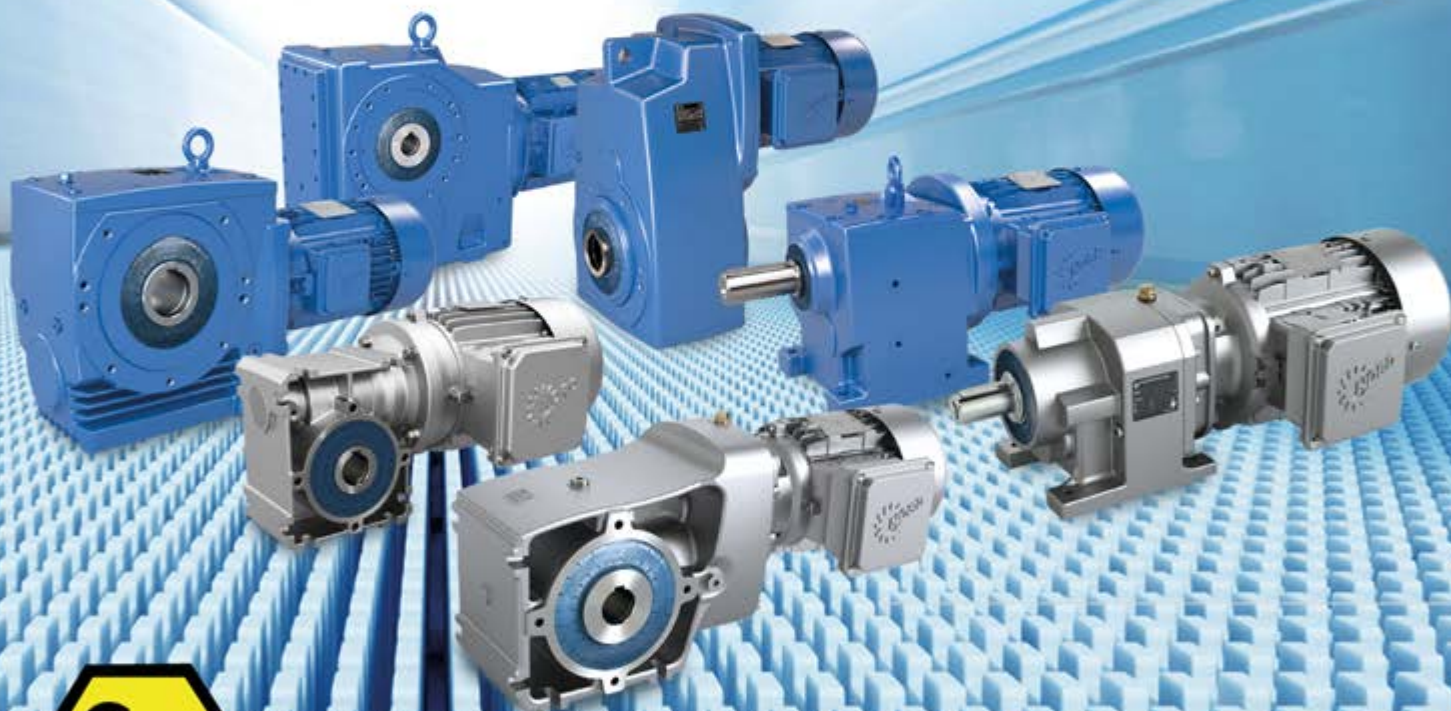
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Component list and manuals available separately, please see “Components Manuals” on our website [www.pebco.com](http://www.pebco.com).

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Product Name W. Grbx w/NEMA Adapt & Motor  
 Motor Speed 1,750 rpm  
 Ratio 100.00  
 Output Speed 18.000 rpm  
 Service Factor 0.80  
 Nominal Output Torque (lb-in) 1,948.00  
 Max. Torque Capacity (lb-in) 1,655.00  
 Motor Type ClassIIDiv2,GroupsF,G T3B165°C  
 Motor Power (HP) 1.000  
 Voltage (V) 230/460  
 Frequency (Hz) 60  
 Duty Cycle S1  
 Motor Enclosure Type IP55  
 Insulation Class F  
 Rated Current 1 (A) 3.88  
 Rated Current 2 (A) 1.94  
 Power Factor 1 0.59  
 Environmental temp. motor 40°C  
 Surface temperature °C 165

Gearbox Mounting Position Universal  
 Housing Type B5 Flange  
 Input Adapter N140TC Ø165  
 Output Shaft Dimensions 1.9375"  
 Flange type II Square Flange with Female  
 Flange Diameter (in) 7,87  
 Flange Location Ship Flange Loose  
 Flange Material Aluminium  
 Breather Non vented gearbox  
 Bushing Kit HW/BUSHING 1.4375  
 Terminal Box Position 1/I  
 Lubricant Type KLUBERSYNTH UH 1 6-680  
 Lubricant Supplier Klüber  
 Oil Classification KLUBERSYNTH UH 1 6-680  
 Qty. lubricant (Qts) 0.381  
 Paint Option Without paint  
 Nameplate/Terminal Box SS Nameplate & T.  
 Box w/Logo  
 CE Logo Yes



EN

B 2000

## Explosion-protected gear units

Operating and Assembly Instructions







## General safety and operating instructions

### 1. General

Depending on its protection class, the device may have live, bare, moving or rotating parts or hot surfaces during operation.

Unauthorised removal of covers, improper use, incorrect installation or operation causes a risk of serious personal injury or material damage.

All transport, installation, commissioning and maintenance work must be carried out by qualified specialist personnel (national accident prevention regulations must be observed).

Within the meaning of this basic safety information, qualified specialist personnel are persons who are familiar with the installation, assembly, commissioning and operation of the product and who have the training and experience to recognise and avoid any hazards and risks.

### 2. Correct use

NORD products may only be used according to the information in the catalogue and the associated technical documentation.

**Compliance** with the operating and installation instructions is a **prerequisite for fault-free operation** and for the fulfilment of any warranty claims. **These operating and installation instructions must be read** before working with the device!

These operating and installation instructions contain important information about **servicing**. They must therefore be kept **close to the device**.

All details regarding technical data and permissible conditions at the installation site must be complied with.

### 3. Transport, storage

Information regarding transport, storage and correct handling must be complied with.

### 4. Installation

The device must be protected against impermissible loads. In particular, during transport and handling, components must not be deformed or changed. Touching of electronic components and contacts must be avoided.

### 5. Electrical Connection

When working on live three-phase motors, the applicable national accident prevention regulations must be complied with (e.g. BGV A3, formerly VBG 4).

The electrical installation must be implemented according to the applicable regulations (e.g. cable cross-section, fuses, earth lead connections).

Information regarding EMC-compliant installation – such as shielding, earthing and installation of cables – can be found in the three-phase motor documentation. Compliance with the limiting values specified in the EMC regulations is the responsibility of the manufacturer of the system or machine.

### 6. Operation

Appropriate safety measures must be taken for applications where failure of the device may result in injury.

Where necessary, systems in which NORD devices are installed must be equipped with additional monitoring and protective equipment according to the applicable safety requirements, e.g. legislation concerning technical equipment, accident prevention regulations, etc.

All covers and guards must be kept closed during operation.

### 7. Maintenance and repairs

After the device has been disconnected from the power supply, live equipment components and power connections should not be touched immediately, because of possible charged capacitors.

Further information can be found in this documentation.

**These safety instructions must be kept in a safe place!**

## Documentation

Name: B 2000  
 Part No.: 6051402  
 Series: Gear units and geared motors  
 Type series:  
 Gear unit types: **Helical gear units**  
                           **NORDBLOC helical gear units**  
                           **Standard helical gear units**  
                           **Parallel shaft gear unit**  
                           **Bevel gear unit**  
                           **Helical worm gear units**  
                           **MINIBLOC worm gear units**  
                           **UNIVERSAL worm gear units**

## Version list

Title, Date	Order number	Comments
B 2000, January 2013	- 6051402 /0413	-
B 2000, September 2014	- 6051402/ 3814	General corrections
B 2000, April 2015	- 6051402 / 1915	New gear unit types SK 10382.1 + SK 11382.1

Table 1: Version list B 2000

## Copyright notice

As an integral component of the device described here, this document must be provided to all users in a suitable form.

Any editing or amendment or other utilisation of the document is prohibited.

## Publisher

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## 1 Notes

### 1.1 General information

Read the Operating Manual carefully prior to performing any work on or putting the gear unit into operation. Strict compliance with the instructions in this Operating Manual is essential. This Operating Manual and all associated special documentation must be kept in the immediate vicinity of the gear unit.

Getriebebau NORD accepts no liability for damage to persons, materials or assets as a result of the non-observance of this Operating Manual, operating errors or incorrect use. General wearing parts, e.g. radial seals are excluded from the warranty.







If additional components are attached to or installed on or in the gear unit (e.g. motor, cooling system, pressure sensor etc.) or components (e.g. cooling system) are supplied with the order, the operating instructions for these components must be observed.

If geared motors are used, compliance with the Motor Operating Manual is also necessary.

If you do not understand the contents of this Operating Manual or additional operating instructions, please consult Getriebebau NORD!

## 1.2 Safety and information symbols


### 1.2.1 Explanation of designations used

 <b>DANGER!</b>	Indicates an immediate danger, which may result in death or serious injury.
 <b>DANGER!</b> 	Indicates an immediate danger, which may result in death or serious injury. Contains important information regarding explosion protection.
 <b>WARNING</b>	Indicates a possibly dangerous situation, which may result in death or serious injury.
 <b>CAUTION</b>	Indicates a possibly dangerous situation, which may result in slight or minor injuries.
<b>NOTICE</b>	Indicates a possibly harmful situation, which may cause damage to the product or the environment.
 <b>Information</b>	Indicates hints for use and useful information.

## 1.3 Correct use

These gear units generate a rotational movement and are intended for use in commercial systems. They satisfy the explosion-protection requirements of Directive 94/9EC (ATEX100a) for the product category indicated on the type plate.

Commissioning (start of proper operation) is prohibited until it has been established that the machine complies with the local laws and directives. The EMC Directive 2004/108/EC and the Machinery Directive 2006/42/EC in their currently valid scope of application must be complied with in particular.

 <b>WARNING</b>	<b>Danger to persons</b>
Appropriate safety measures must be taken for applications where failure of a gear unit or geared motor may result in injury.	
Safeguard a wide area around the hazard zone.	



**! WARNING**
**Explosion hazard**


Only components which comply with the applicable regulations of Directive 94/9/EU may be fitted and operated.

Observe the Declaration of Conformity and all safety information for the components.

**! WARNING**
**Material damage and personal injury**

If the gear unit is not used as designed, this may cause damage to the gear unit or the premature failure of components. Personal injury as a result of this cannot be ruled out.

Strict compliance with the technical data on the type plate is essential. The documentation must be observed.

## 1.4 Safety information

**Observe all safety information**, including that provided in the individual sections of this Operating Manual. All national and other regulations on safety and accident prevention must also be observed.

**! DANGER!**
**Explosion hazard**


Explosion hazard. Failure to comply may cause severe, or even fatal injuries.

All work, e.g. transportation, storage, installation, electrical connection, commissioning, servicing and maintenance must be performed in a non-explosive atmosphere.

**! DANGER!**
**Severe personal injury**

Serious physical and property damage may result from inappropriate installation, non-designated use, incorrect operation, non-compliance with safety information, unauthorised removal of housing components or safety covers and structural modifications to the gear unit.

- All work, e.g. transportation, storage, installation, electrical connection, commissioning, servicing, maintenance and repair must only be performed by qualified specialist personnel.
- Observe the Operating Manual
- Observe the safety information
- Observe the safety and accident prevention regulations.
- Tighten the drive elements or secure the parallel key before switching on.
- Do not make any structural modifications.
- Do not remove any safety devices.
- If necessary, wear hearing protection when working in the immediate vicinity of the gear unit.
- All rotating components must be provided with guards. In standard cases, covers are fitted by NORD. The covers must always be used if contact protection is not provided by other methods.

**DANGER!****Severe personal injury**

The surfaces of gear units or geared motors may become hot during or shortly after operation.

- Installation and maintenance work must only be performed when gear unit is at a standstill and has cooled down. The drive must be isolated and secured to prevent accidental start-up.
- Wear protective gloves.
- Shield hot surfaces with contact guards.
- Do not store inflammable objects or substances in the immediate vicinity of the gear unit.

**WARNING****Serious personal injury and material damage**

Serious injury and material damage due to improper transport are possible.

- No additional loads may be attached.
- Transportation aids and lifting gear must have an adequate load-bearing capacity.
- Pipes and hoses must be protected from damage.

**CAUTION****Cutting hazard**

Danger of cuts from exterior edges of attachment adapters, flanges and covers.

Contact freezing with metallic components in case of low temperatures.

In addition to personal protective equipment, wear suitable protective gloves and suitable goggles during assembly, commissioning, inspection and maintenance, in order to prevent injuries.

It is recommended that repairs to NORD Products are carried out by the NORD Service department.

## 1.5 Other documents

Further information may be obtained from the following documents:

- Gear unit catalogues (G1000, G1012, G1014, G1035, G1050, G2000),
- Operating and maintenance instructions for the electric motor,
- if applicable, the Operating Manuals for attached or supplied options

## 1.6 Disposal

Observe the current local regulations. In particular, lubricants must be collected and disposed of correctly.

Gear unit components	Material
Gear wheels, shafts, rolling bearings, parallel keys, locking rings, ...	Steel
Gear unit housing, housing components, ...	Grey cast iron
Light alloy gear unit housing, light alloy gear unit housing components, ...	Aluminium
Worm gears, bushes, ...	Bronze
Radial seals, sealing caps, rubber components,...	Elastomers with steel
Coupling components	Plastic with steel
Flat seals	Asbestos-free sealing material
Gear oil	Additive mineral oil
Synthetic gear oil (type plate code: CLP PG)	Polyglycol-based lubricants
Cooling spiral, embedding material of the cooling spiral, screw fittings	Copper, epoxy, yellow brass

**Table 2: Disposal of materials**

## 2 Description of gear unit

### 2.1 Type designations and gear unit types

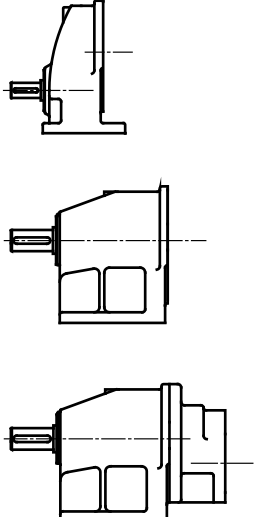
Gear unit types / Type designations			
<b>Helical gear units</b>			
SK 11E, SK 21E, ... SK 51E (1-stage) SK 02, SK 12, ... SK 52, SK 62N (2-stage) SK 03, SK 13, SK 23, SK 33N, SK 43, SK 53 (3-stage)			
			
Versions / Options			
-	Foot-mounted version	IEC	Standard IEC motor mounting
F	Output flange B5	NEMA	Standard NEMA motor attachment
XZ	Base and output flange B14	W	Free input shaft
XF	Base and output flange B14	6	Viton radial seals
VL	Reinforced bearings	OA	Oil expansion vessel
AL	Solid shaft, reinforced axial bearings	SO1	Synthetic oil ISO VG 220

Table 3: Helical gear units - Type designation and gear unit types

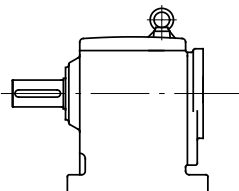
Gear unit types / Type designations			
<b>Helical gear units</b>			
SK 62, SK 72, SK 82, SK 92, SK 102 (2-stage) SK 63, SK 73, SK 83, SK 93, SK 103 (3-stage)			
			
Versions / Options			
-	Foot-mounted version	NEMA	Standard NEMA motor attachment
F	Output flange B5	W	Free input shaft
XZ	Base and output flange B14	6	Viton radial seals
XF	Base and output flange B14	OA	Oil expansion vessel
VL	Reinforced bearings	SO1	Synthetic oil ISO VG 220
IEC	Standard IEC motor mounting		

Table 4: Large helical gear units - Type designation and gear unit types

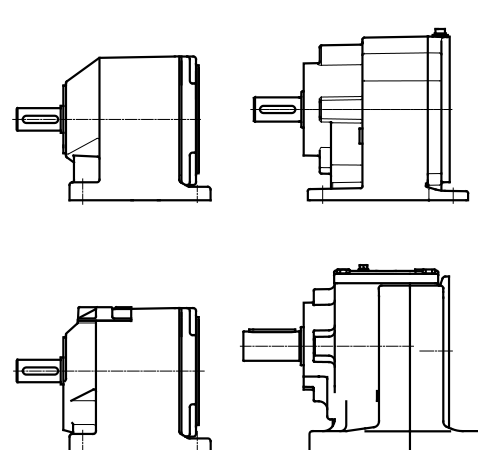
Gear unit types / Type designations	
<b>NORDBLOC helical gear units</b>	
SK 320, SK 172, SK 272, .... SK 972 (2-stage) SK 273, SK 373, .... SK 973 (3-stage) SK 072.1, SK 172.1 (2-stage) SK 372.1, .... SK 672.1 (2-stage) SK 373.1, .... SK 673.1 (3-stage) SK 772.1, SK 872.1, SK 972.1 (2-stage) SK 773.1, SK 873.1, SK 973.1 (3-stage)	
	
Versions / Options	
-	Foot-mounted version
F	Output flange B5
XZ	Base and output flange B14
XF	Base and output flange B14
VL	Reinforced bearings
IEC	Standard IEC motor mounting
NEMA	Standard NEMA motor attachment
W	Free input shaft
6	Viton radial seals
OA	Oil expansion vessel
SO1	Synthetic oil ISO VG 220

Table 5: NORDBLOC helical gear units - Type designation and gear unit types

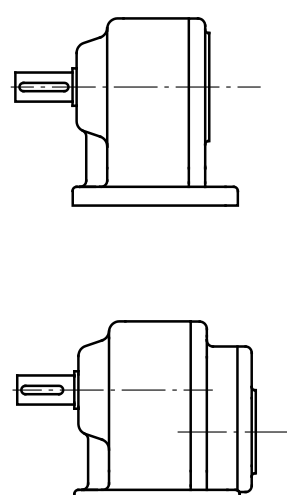
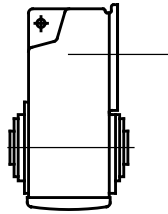
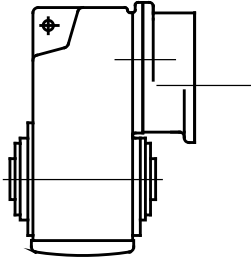
Gear unit types / Type designations	
<b>Standard helical gear units</b>	
SK 0, SK 01, SK 20, SK 25, SK 30, SK 33 (2-stage) SK 000, SK 010, SK 200, SK 250, SK 300, SK 330 (3-stage)	
	
Versions / Options	
-	Foot-mounted version
Z	Output flange B14
XZ	Base and output flange B14
XF	Base and output flange B14
F	Output flange B5
5	Reinforced output shaft
V	Reinforced drive
AL	Solid shaft, reinforced axial bearings
IEC	Standard IEC motor mounting
NEMA	Standard NEMA motor attachment
W	Free input shaft
6	Viton radial seals
SO1	Synthetic oil ISO VG 220

Table 6: NORDBLOC helical gear units - Type designation and gear unit types

## 2 Description of gear unit

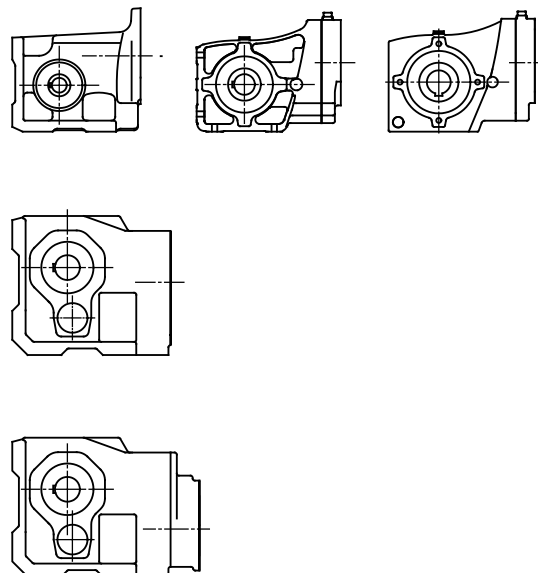
Gear unit types / Type designations	
<b>Parallel shaft gear unit</b> SK 0182NB, SK 0282NB, SK 1282, .... SK 9282, SK 10282, SK 11282 (2-stage) SK 1382NB, SK 2382, ..... SK 9382, SK 10382, SK 11382, SK 12382 (3-stage) SK 10382.1, SK 11382.1	
 	
Versions / Options	
A	Hollow shaft version
V	Solid shaft version
Z	Output flange B14
F	Output flange B5
X	Foot mounting
S	Shrink disc
VS	Reinforced shrink disc
EA	Hollow shaft with internal spline
G	Rubber buffer
VG	Reinforced rubber buffer
B	Fixing element
H	Covering cap as contact guard
H66	Covering cap IP66
VL	Reinforced bearings
VLII	Agitator version
VLIII	Drywell agitator version
SCX	Screw Conveyor Flange
IEC	Standard IEC motor mounting
NEMA	Standard NEMA motor attachment
W	Free input shaft
6	Viton radial seals
OA	Oil expansion vessel
SO1	Synthetic oil ISO VG 220
CC	Casing cover with cooling spiral
OT	Oil storage tank

**Table 7: Parallel shaft gear units - Type designation and gear unit types**

## Gear unit types / Type designations

### Bevel gear units

SK 92072, SK 92172, SK 92372, SK 92672, SK 92772  
SK 92072.1, SK 92172.1, SK 92372.1, SK 92672.1,  
SK 92772.1, SK 93072.1, SK 93172.1, SK 93372.1,  
SK 93672.1, SK 93772.1 (2-stage)  
SK 9012.1, SK 9016.1, SK 9022.1, SK 9032.1, SK 9042.1,  
SK 9052.1, SK 9062.1, SK 9072.1, SK 9082.1, SK 9086.1,  
SK 9092.1, SK 9096.1 (3-stage)  
SK 9013.1, SK 9017.1, SK 9023.1, SK 9033.1,  
SK 9043.1, SK 9053.1 (4-stage)



### Versions / Options

-	Foot-mounted version	H	Covering cap as contact guard
A	Hollow shaft version	H66	Covering cap IP66
V	Solid shaft version	VL	Reinforced bearings
L	Solid shaft both sides	VLII	Agitator version
Z	Output flange B14	VLIII	Drywell agitator version
F	Output flange B5	SCX	Screw Conveyor Flange
X	Foot mounting	IEC	Standard IEC motor mounting
D	Torque arm	NEMA	Standard NEMA motor attachment
K	Torque bracket	W	Free input shaft
S	Shrink disc	6	Viton radial seals
VS	Reinforced shrink disc	OA	Oil expansion vessel
EA	Hollow shaft with internal spline	SO1	Synthetic oil ISO VG 220
R	Back stop	CC	Casing cover with cooling spiral
B	Fixing element		

Table 8: Bevel gear units - Type designation and gear unit types

## 2 Description of gear unit

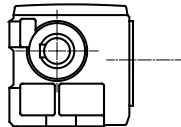
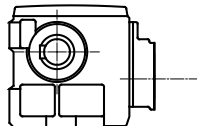
Gear unit types / Type designations			
<b>Helical worm gear units</b>			
SK 02040, SK 02050, SK 12063, SK 12080, SK 32100, SK 42125 (2-stage) SK 13050, SK 13063, SK 13080, SK 33100, SK 43125 (3-stage)			
 			
Versions / Options			
-	Foot mounting with solid shaft	B	Fixing element
A	Hollow shaft version	H	Covering cap as contact guard
V	Solid shaft version	H66	Covering cap IP66
L	Solid shaft both sides	VL	Reinforced bearings
X	Foot mounting	IEC	Standard IEC motor mounting
Z	Output flange B14	NEMA	Standard NEMA motor attachment
F	Output flange B5	W	With free drive shaft
D	Torque support	6	Viton radial seals
S	Shrink disc	OA	Oil expansion vessel

Table 9: Helical worm gear units - Type designation and gear unit types

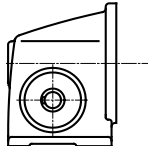
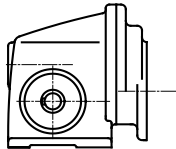
Gear unit types / Type designations			
<b>MINIBLOC worm gear units</b>			
SK 1S 32, SK 1S 40, SK 1S 50, SK 1S 63, SK 1SU... , SK 1SM 31, SK 1SM 40, SK 1SM 50, SK 1SM 63, (1-stage) SK 2S32NB, SK 2S40NB, SK 2S50NB, SK 2S63NB, SK 2SU..., SK 2SM40, SK 2SM50, SK 2SM63 (2-stage)			
 			
Versions / Options			
-	Foot mounting with solid shaft	X	Foot mounting
A	Hollow shaft version	B	Fixing element
V	Solid shaft version	IEC	Standard IEC motor mounting
L	Solid shaft both sides	NEMA	Standard NEMA motor attachment
Z	Output flange B14	W	With free drive shaft
F	Output flange B5	6	Viton radial seals
D	Torque support		

Table 10: MINIBLOC - Type designation and gear unit types

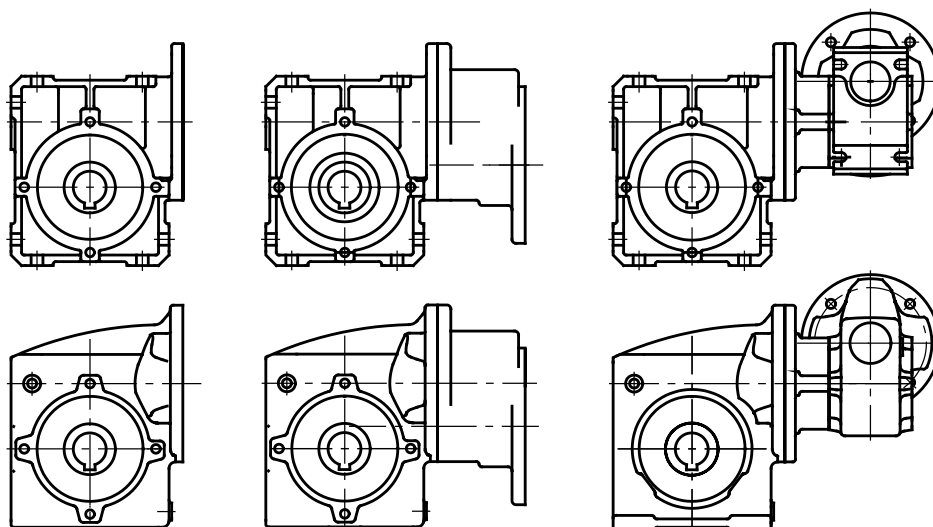


SK1SI75FJ-N140TC-80LH/4 CUS IID2

### Gear unit types / Type designations

#### UNIVERSAL worm gear units

SK 1SI31, SK 1SI40, SK 1SI50, SK 1SI63, **SK 1SI75**,  
 SK 1SID31, SK 1SID40, SK 1SID50, SK 1SID63, SK 1SID75  
 SK 1SIS31,..., SK 1SIS75,  
 SK 1SD31, SK 1SD40, SK 1SD50, SK 1SD63,  
 SK 1SIS-D31,..., SK 1SIS-D63  
 SK 1SMI31, SK 1SMI40, SK 1SMI50, SK 1SMI63, SK 1SMI75  
 SK 1SMID31,..., SK 1SMID63 (1-stage)  
 SK 2SD40, SK 2SD50, SK 2SD63, SK 1SI.../31, SK 1SI.../H10,  
 SK 2SID40,..., SK 2SID63  
 SK 2SIS-D40,..., SK 2SIS-D63  
 SK 2SMI40, SK 2SMI50, SK 2SMI63  
 SK 2SMID40, SK 2SMID50, SK 2SMID 63 (2-stage)



#### Versions / Options

V	Solid shaft or plug-in shaft	H10	Modular contrate pre-stage
A	Hollow shaft version	/31	Worm pre-stage
L	Solid shaft both sides	/40	Worm pre-stage
X	Feet on three sides	IEC	Standard IEC motor mounting
Z	Output flange B14	NEMA	Standard NEMA motor attachment
F	Output flange B5	W	With free drive shaft
D	Torque support	6	Viton radial seals
H	Covering cap		

Table 11: UNIVERSAL worm gear units - Type designation and gear unit types

Double gear units consist of two single gear units. They are to be treated as per the instructions in this Manual, i.e. as two individual gear units.

Type designation for double gear units: e.g. SK 73 /22 (consisting of single gear units SK 73 and SK 22).

### 3 Assembly instructions, storage, preparation, installation

Please observe all general safety instructions (please see chapter 1.4 "Safety information"), the safety information in the individual sections and the proper use (please see chapter 1.3 "Correct use").

#### 3.1 Transporting the gear unit



##### **WARNING**

##### **Hazard due to heavy loads**

Severe injuries and material damage due to falling or tipping heavy loads are possible.

- Standing under the gear unit during transport is **extremely dangerous**.
- To prevent injury, the danger area must be generously cordoned off.
- Only transport using the eyebolts attached to the gear unit.
- No additional loads may be attached.
- If geared motors have an additional eyebolt attached to the motor, this must also be used.
- The thread of the eyebolt must be fully screwed in.
- Avoid pulling the eyebolts at an angle.

##### **NOTICE**

##### **Gear unit damage**

Damage to the gear unit due to improper use is possible.

- Prevent damage to the gear unit. Impacts to the free ends of the shafts may cause internal damage to the gear unit.
- Use adequately dimensioned and **suitable means of transportation**. Lifting tackle must be designed for the weight of the gear unit. The weight of the gear unit can be obtained from the dispatch documents.

## 3.2 Storage

**For short-term storage before commissioning, please observe the following:**

Store in the installation position (please see chapter 6.1 "Configurations and maintenance") and secure the gear unit against falling,

- Lightly oil bare metal housing surfaces and shafts
- Store in a dry place.
- Temperature in the range from – 5 °C to + 50 °C without large fluctuations,
- Relative humidity less than 60 %,
- No direct exposure to sunlight or UV light,
- No aggressive, corrosive substances (contaminated air, ozone, gases, solvents, acids, alkalis, salts, radioactivity etc.) in the immediate vicinity,
- No vibration or oscillation

## 3.3 Long-term storage



### CAUTION

### Injury to persons

Incorrect, or excessively long storage may result in malfunctions of the gear unit.

Perform an inspection of the gear unit prior to commissioning if the permissible storage time has been exceeded.



### Information

### Long-term storage

For storage or standstill periods in excess of 9 months, Getriebebau NORD recommends the long-term storage option.

With the long-term storage option and the use of the measures listed below, storage for up to 2 years is possible. As the actual influences on the unit greatly depend on the local conditions, these times should only be regarded as guide values.

### 3 Assembly instructions, storage, preparation, installation

---

#### Conditions of the gear unit and storage area for long-term storage prior to commissioning:

- Store in the installation position (please see chapter 6.1 "Configurations and maintenance") and secure the gear unit against falling.
- Transportation damage to the external paint must be repaired. Check that a suitable rust inhibitor is applied to the flange bearing surfaces. If necessary apply a suitable rust inhibitor to the surfaces.
- Gear units with the long-term storage option are completely filled with lubricant or have VCI corrosion protection agent mixed with the gear oil (see adhesive label on the gear unit, or are not filled with oil, but rather with small quantities of VCI concentrate.
- The sealing band in the vent plug must not be removed during storage. The gear unit must remain sealed tight.
- Store in a dry place.
- In tropical regions, the gear unit must be protected against damage by insects
- Temperature in the range from – 5 °C to + 40 °C without large fluctuations,
- Relative humidity less than 60 %,
- No direct exposure to sunlight or UV light,
- No aggressive, corrosive substances (contaminated air, ozone, gases, solvents, acids, alkalis, salts, radioactivity etc.) in the immediate vicinity,
- No vibration or oscillation

#### Measures during storage or standstill periods

- If the relative humidity is <50 % the gear unit can be stored for up to 3 years.

#### Measures before commissioning

- If the storage or standstill period exceeds 2 years or the temperature during short-term storage has greatly deviated from the standard range, the lubricant in the gear unit must be replaced before commissioning.
- If the gear unit is completely filled, the oil level must be reduced before commissioning.
- For gear units without oil filling, the oil level for the version must be filled before commissioning. The VCI concentrate may remain in the gear unit. Lubricant quantities and types must be filled according to the details on the type plate.

### 3.4 Inspecting the drive unit

#### DANGER!

#### Explosion hazard



Explosion hazard. Failure to comply may cause severe, or even fatal injuries.

All work, e.g. transportation, storage, installation, electrical connection, commissioning, servicing and maintenance must be performed in a non-explosive atmosphere.

**The drive unit must be inspected and may only be installed if:**

- No damage, e.g. due to storage or transport is apparent. In particular the radial seals, the sealing caps and the covers must be inspected for damage.
- No leakage or no oil loss is visible.
- No corrosion or other indications of incorrect or damp storage is apparent.
- The packaging material has been completely removed.

### 3.5 Checking the type plate data

#### DANGER!



#### Explosion hazard



Explosion hazard. Failure to comply may cause severe, or even fatal injuries.

It must be checked and ensured that the gear unit type, all technical data and the ATEX labelling conform to the planning of the plant or the machine.


The type plate must be firmly attached to the gear unit and must not be subjected to permanent soiling. Please contact the NORD service department if the type plate is illegible or damaged.

		Getriebebau NORD GmbH & Co. KG D-22934 Bargteheide			
Typ	SK 12-IEC63/2G				
No.	1003345823		$i_{ges}$	72,63	
$n_2$	18	$min^{-1}$	$n_1$	1307,34	$min^{-1}$
$M_2$	96	Nm	$P_1$	0,18	kW
$F_{R2}$	3,35	kN	$F_{R1}$		kN
$F_{A2}$	4	kN	$F_{A1}$		kN
Oil	CLP 220		$x_{R2}$	50	mm
	II 2G c IIC T4 X		MI	24000	h
			S		

085 0150-0

Fig. 1: Type plate (example)

### 3 Assembly instructions, storage, preparation, installation

Explanation of the type plate			
Abbreviations	Unit	Designation	See Section
Type	-	NORD gear unit type	
No.	-	Serial number	
$i_{ges}$	-	Overall gear unit ratio	
$n_2$	rpm	Rated speed of gear unit drive shaft*	
$n_1$	rpm	Rated speed of the gear unit drive shaft or the drive motor*	
IM	-	Configuration (installation orientation)	6.1
M2	Nm	Max. permissible gear unit drive shaft torque	
$P_1$	kW	Max. permissible drive power or motor power	
Bj	-	Year of manufacture:	
$F_{R2}$	kN	Max. permissible transverse force on the gear unit driven shaft	3.9
$F_{R1}$	kN	Max. permissible transverse force on the gear unit drive shaft for option W	3.9
$T_u$	°C	Permissible ambient temperature for the gear unit	
$F_{A2}$	kN	Max. permissible axial force on the gear unit driven shaft	3.9
$F_{A1}$	kN	Max. permissible axial force on the gear unit drive shaft for option W	3.9
MI	h	Interval for general overhaul of the gear unit in operating hours or according to the specification of the dimensionless maintenance class CM	5.2
$x_{R2}$	mm	Max. dimension for the point of application of the transverse force $F_{R2}$	3.9
Oil	-	Gear unit oil type (standard designation)	6.2
Last line 	-	Labelling as per ATEX (DIN EN 13463-1): 1. Group (always II, not for mines) 2. Category (2G, 3G for gas or 2D, 3D for dust) 3. Ignition protection type if fitted (c) 4. Explosion group if applicable (IIC, IIB) 5. Temperature class (T1-T3 or T4 for gas) or max. surface temperature (e.g. 125°C for dust) or special max. surface temperature see special documentation (TX) 6. Temperature measurement on commissioning (X)	4.3
S	-	Number of the special documentation, consisting of serial no. / year	
* The maximum permissible speeds are 10 % above the rated speed, if the maximum permissible drive power $P_1$ is not exceeded.			
If the fields $F_{R1}$ , $F_{R2}$ , $F_{A1}$ and $F_{A2}$ are empty, the forces are zero. If the field $x_{R2}$ is empty, the point of application of force $F_{R2}$ is central on the drive shaft journal (please see chapter 3.9 "Fitting hubs on the gear shafts").			

Please note that for geared motors (gear units with attached electric motors) the electric motor has its own type plate and separate ATEX designation. The motor labelling must also comply with data for the planning of the plant or the machine.

**The lowest explosion protection level on the gear unit and the motor labelling applies for the geared motor unit.**

If the electric motor is driven with a frequency inverter, the motor requires ATEX approval for inverter operation. If the motor is operated with an inverter, significant differences between the nominal speeds on the type plates of the motor and the gearbox are normal and permissible. For operation of the motor with the mains supply, differences of the nominal speeds on the motor and the gear unit of up to  $\pm 60$  rpm are permissible.

### 3.6 Checking the configuration


**DANGER!**

#### Explosion hazard



Explosion hazard. Failure to comply may cause severe, or even fatal injuries.

- The gear unit may only be operated in the stated configuration.
- The permissible configuration is stated on the name plate (IM...). If an X is present in the field IM, the special documentation, whose number is in field S, must be observed. Section 6.1 "Configurations and maintenance" or the special documentation shows the versions of the individual gear unit types.
- It must be checked and ensured that the configuration as stated on the type plate complies with the installation orientation and that the installation orientation does not change during operation.
- The UNIVERSAL worm gear units type SK1SI... do not depend on the configuration, as with these types of gear unit, the abbreviation UN is entered in the IM field of the type plate.

## 3 Assembly instructions, storage, preparation, installation

### 3.7 Preparing for installation



#### CAUTION

#### Injury to persons

Transport damage may cause malfunctions of the gear unit, which may cause material damage or personal injury.

Please inspect the delivery for transport and packaging damage immediately on receipt. Report any damage to the carrier immediately. Gear units with transport damage must not be commissioned.

The drive unit must be inspected and may only be installed if no transportation damage or leaks are visible. In particular the radial seals and the sealing caps must be inspected for damage.

Pay attention to leaked lubricants, they may cause slips.

All bare metal surfaces and shafts of the gear unit are protected against corrosion with oil, grease or corrosion protection agents before shipping.

Thoroughly remove all oil, grease or corrosion protection agents and any dirt from the shafts and flange surfaces before assembly.



#### DANGER!

#### Explosion hazard



Explosion hazard. Failure to comply may cause severe, or even fatal injuries.

Care must be taken that drive elements attached to the gear unit, such as clutches, pulleys etc. and drive motors are also ATEX-compliant.

In applications where an incorrect rotational direction may result in damage or potential risk, the correct rotational direction of the drive shaft is to be established by test running the drive when uncoupled and guaranteeing such for subsequent operation.

Gears with integrated return stops are marked with arrows on the driven/driving sides. The arrows point in the rotation direction of the gear unit. When connecting the motor and during motor control, it must be ensured that the gear unit can only operate in the direction of rotation. (For further explanations see catalogue G1000 and WN 0-000 40)

#### NOTICE

#### Gear unit damage

With gear units with an integrated back stop, switching the drive motor to the blocked direction of rotation, i.e. incorrect direction of rotation, may result in damage to the gear unit.

Take care that the direction of rotation of the gear unit is correct when connecting the motor and the motor control unit.



Ensure that no aggressive or corrosive substances are present in the area surrounding the installation site or are subsequently expected during operation, which attack metal, lubricants or elastomers. In case of doubt, please contact Getriebebau NORD and take the recommended action.

Oil expansion tanks (Option OA) must be fitted in accordance with works standard WN 0-530 04. For M10 x 1 screw fittings, the enclosed factory standard WN 0-521 35 must also be observed.

The pressure vent must be activated prior to commissioning. To activate, remove the transport securing devices.

Double gear units consist of two single units and are equipped with 2 oil chambers and 2 pressure vents. For the position of the vent plug, refer to (please see chapter 6.1 "Configurations and maintenance").

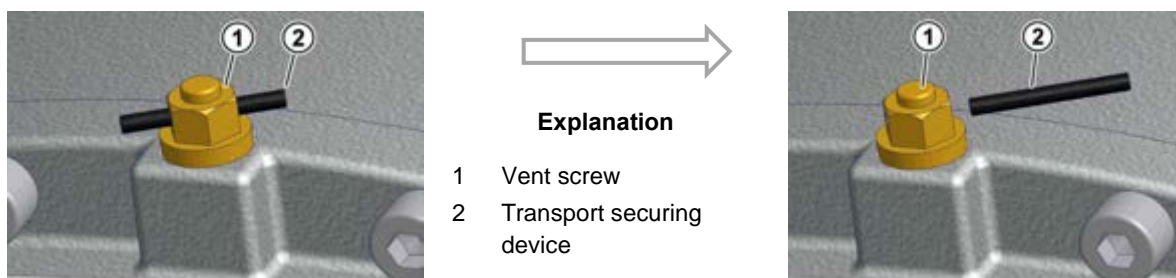


Fig. 2: Activation of the pressure vent

### 3.8 Installing the gear unit



#### DANGER!

#### Explosion hazard



Explosion hazard. Failure to comply may cause severe, or even fatal injuries.

- No explosive atmosphere must be present when installing the gear unit.
- The cooling air supplied to the gear unit/geared motor must be within the permissible temperature range stated on the type plate.
- In case of direct sunlight falling onto the gear unit, the cooling air supplied to the gear unit/geared motor must be at least 10 °C below the highest permissible temperature of the ambient temperature range  $T_u$ , which is stated on the type plate.



#### WARNING

#### Danger of burns

The surfaces of gear units or geared motors may become hot during or shortly after operation.

Hot surfaces which can be touched directly must be protected with a contact guard.

**NOTICE****Damage to the gear unit due to overheating**

The gear unit may be damaged by overheating.

During installation::

- Ensure a free flow of air to all sides of the gear unit.
- Ensure adequate space around the gear unit.
- With geared motors, the cooling air of the motor fan must be able to flow unobstructed onto the gear unit.
- Do not enclose or encase the gear unit/geared motor.
- Do not subject the gear unit to highly energetic radiation.
- Do not direct warm exhaust air from other units onto the gear unit/geared motor.
- The base or flange to which the gear unit is attached must not input any heat into the gear unit during operation.
- Do not allow dust to accumulate in the area of the gear unit

The base or flange to which the gear unit is fitted should be vibration-free, torsionally rigid and flat (flatness error <0.2 mm).

All contamination to the bolting surfaces of gear unit and base and/or flange must be thoroughly removed.

The gear housing must always be earthed. With geared motors, earthing via the motor connection must be ensured.

The gear unit must be precisely aligned with the drive shaft of the machine in order to prevent additional forces from being imposed on the gear unit due to distortion.

Welding of the gear unit is prohibited. The gear unit must not be used as the earth connection for welding work, as this may cause damage to the bearings and gear wheels.

**The gear unit must be installed in the correct configuration** (please see chapter 3.6 "Checking the configuration") and (please see chapter 6.1 "Configurations and maintenance").

All gear unit feet and/or all flange bolts on each side must be used. Bolts must have a minimum quality of 10.9. The bolts must be tightened with the correct torques (please see chapter 6.3 "Torque values"). Tension-free bolting must be ensured, particularly for gear units with a foot and flange.

Oil checking and oil drain screws must be accessible.

### 3.9 Fitting hubs on the gear shafts

**NOTICE****Gear unit damage**

The gear unit may be damaged by axial forces.

Do not subject the gear unit to harmful axial forces when fitting the hubs. In particular, do not hit the hubs with a hammer.

Drive and driven elements, e.g. coupling and chain-wheel hubs must be mounted onto the drive and driven shaft of the gear unit using suitable pullers that will not apply damaging axial forces onto the gear unit. In particular, do not hit the hubs with a hammer.

## *i* Information

## Assembly

Use the end thread of the shafts for pulling. Fitting can be aided by coating the hub with lubricant or heating it up to approx. 100 °C beforehand.

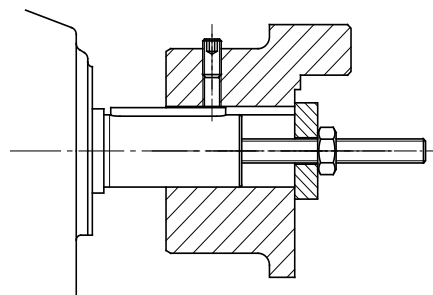


Fig. 3: Example of a simple pulling device



## DANGER!

## Explosion hazard



Explosion hazard. Failure to comply may cause severe, or even fatal injuries.

Care must be taken that drive and driven elements attached to the gear unit must also be ATEX-compliant.



## DANGER!

## Severe personal injury

There is a danger of injury due to rapidly rotating drive and driven elements.

Drive and driven elements, such as belt drives, chain drives, shrink disks, fans and couplings must be fitted with contact protection.

**Driven elements must only introduce the maximum radial transverse forces  $F_{R1}$  and  $F_{R2}$  as stated in the catalogue and the axial forces  $F_{A1}$  and  $F_{A2}$  into the gear unit** (please see chapter 3.5 "Checking the type plate data"). Observe the correct tension, particularly on belts and chains.

Additional loads due to unbalanced hubs are not permitted.

# DANGER!

## Explosion hazard



Explosion hazard. Failure to comply may cause severe, or even fatal injuries.

- The radial force must be applied to the gear unit as closely as possible.
- For drive shafts with free shaft ends – Option W – the maximum permissible transverse force  $F_{R1}$  applies for the application of the transverse force to the centre of the free shaft journal.
- For driven shafts, the application of the transverse force  $F_{R2}$  must not exceed the dimension  $X_{R2}$ .
- If the transverse force  $F_{R2}$  for the driven shaft is stated on the type plate, but no dimension  $X_{R2}$  is stated, the application of the force is assumed to be to the centre of the shaft journal.

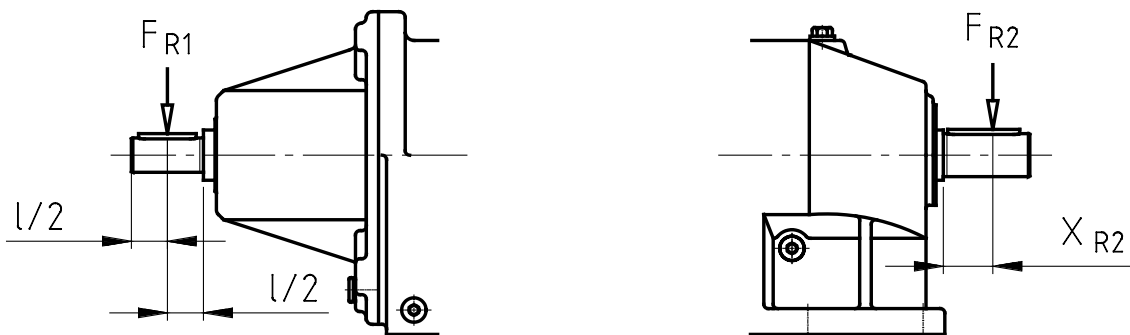


Fig. 4: Permissible application of force to drive and driven shafts

## 3.10 Fitting push-on gear units

### NOTICE

### Gear unit damage

The bearings, gear wheels, shafts and housing may be damaged by incorrect fitting.

- Observe the assembly instructions.
- The push-on gear unit must be fitted onto the shaft using a suitable puller, which will not exert damaging axial forces on the gear unit. In particular, do not hit the gear unit with a hammer.

Assembly and subsequent dismantling is aided by applying an anti-corrosive lubricant to the shaft before fitting (e.g. NORD Anti-Corrosion Part No. 089 00099). Excess grease or anti-corrosion agent may escape after assembly and may drip off. Clean these points on the driven shaft after a running-in time of approx. 24 hours. This escape of grease is not due to a leak in the gear unit.

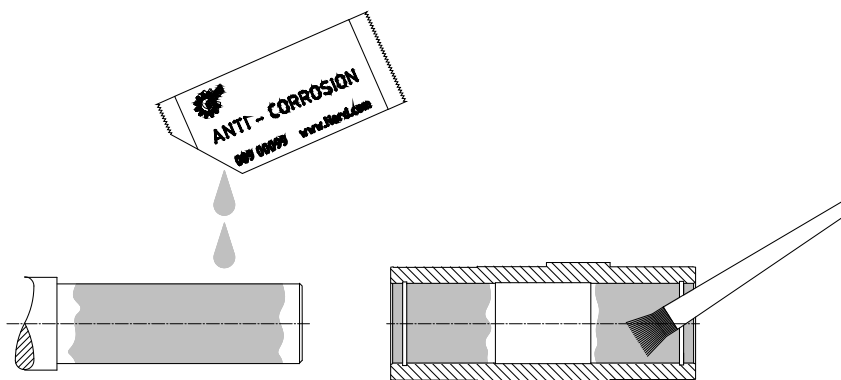


Fig. 5: Applying lubricant to the shaft and the hub

### Information

### Fixing element

The gear unit can be fitted to shafts with and without a shoulder using the fastening element (Option B). Tighten the bolt of the fastening element to the correct torque (please see chapter 6.3 "Torque values"). For gear units with option H66, the factory-fitted closing cap must be removed before assembly.

For push-on gear units with option H66 and fastening element (Option B) the pressed-in closing cap must be pushed out before fitting the gear unit. The pressed-in closing cap may be destroyed during dismantling. As standard a second closing cap is supplied as a loose spare part. After fitting the gear unit, fit the new / new condition closing cap as described in Section 3.12 "Fitting the covers"



Fig. 6: Removing the factory-fitted closing cap

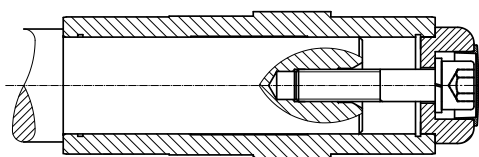
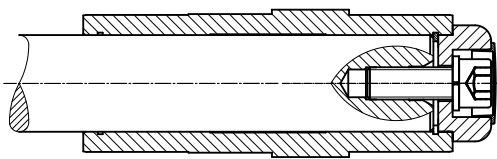


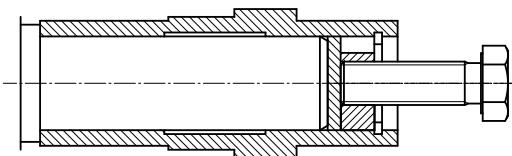
Fig. 7: Gear unit mounted to shaft with a shoulder using the fastening element

### 3 Assembly instructions, storage, preparation, installation



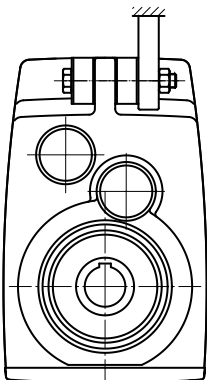
**Fig. 8: Gear unit mounted to shaft without a shoulder using the fastening element**

A gear unit can be dismantled from a shaft with a shoulder using the following device, for example.



**Fig. 9: Dismantling using dismantling device**

When assembling push-on gears with torque supports, the support must not be distorted. Tension-free mounting is aided by the rubber buffer (Option G or VG).



**Fig. 10: Mounting the rubber buffer (Option G and/or VG) on parallel shaft gear units**

To fit the rubber buffer, tighten the screw fastening until there is no play between the contact surfaces when there is no load.

Then turn the fastening nut (only applies for screw fastenings with adjusting threads) half a turn in order to pre-tension the rubber buffer. Greater pre-tension is not permissible.

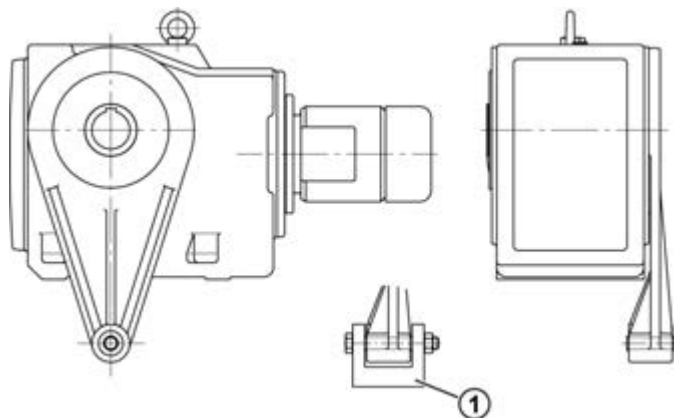


## WARNING

## Risk of injury

The gear unit may suddenly rotate around the shaft if the bolts are loosened.

Secure the screw fastening against loosening, e.g. with Loctite 242 or a second nut.



### Explanation

- 1 Always support torque support on both sides

**Fig. 11: Attaching the torque support on bevel gear and worm gear units**

Tighten the fastenings of the torque support with the correct tightening torques (please see chapter 6.3 "Torque values") and secure against loosening (e.g. Loctite 242, Loxeal 54-03).

### 3.11 Fitting shrink discs

:

<b>CAUTION</b>	<b>Risk of injury</b>
Risk of injury from incorrect mounting and dismantling of the shrink disc. Observe the instructions.	
<b>NOTICE</b>	<b>Gear unit damage</b>
If the tensioning bolts are tightened without the solid shaft inserted, the hollow shaft may be permanently deformed. Do not tighten bolts if the solid shaft is not inserted!	

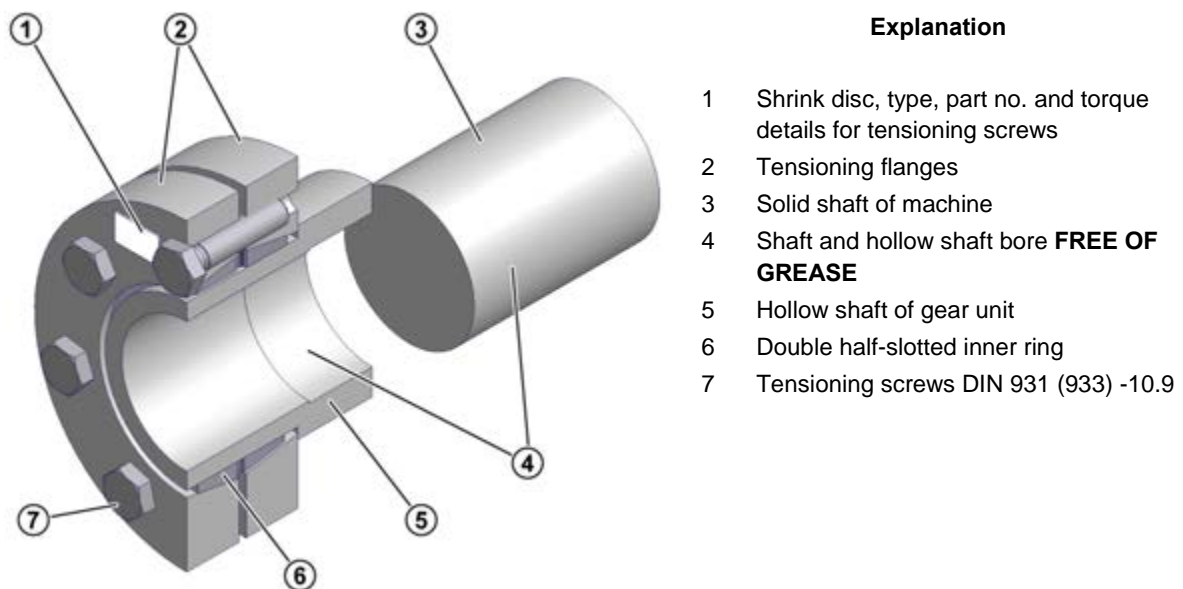


Fig. 12: Hollow shaft with shrink disc

The shrink discs are supplied by the manufacturer ready for fitting. They must not be dismantled prior to fitting.

The solid shaft of the machine runs **free of grease** in the hollow shaft of the gear unit.



### Assembly sequence

1. Remove any transport securing devices.
2. Loosen but do not remove tightening bolt and tighten gently by hand until there is no play between the flanges and the inner ring.
3. Slide the shrink disc onto the hollow shaft until the outer clamping flange is flush with the hollow shaft. The shrink disc is easier to slide on if the bore of the inner ring is lightly greased.
4. Prior to mounting, grease the solid shaft only in the area which will later come into contact with the bronze bush in the hollow shaft of the gear unit. Do not grease the bronze bush, in order to prevent grease penetrating the area around the shrink connection.
5. The hollow shaft of the gear unit must be completely de-greased and **completely free of grease**.
6. In the area of the shrink connection the solid shaft of the machine must be degreased and **completely free of grease**.
7. Insert the solid shaft of the machine into the hollow shaft so as to completely fill the area around the shrink connection.
8. Position the clamping flange by gently tightening the bolts.
9. Tighten the tensioning bolts successively in a clockwise direction by several turns – not crosswise – with approx.  $\frac{1}{4}$  rotation per turn. Tighten the bolts with a torque wrench to the torque indicated on the shrink disc.
10. When the tensioning bolts have been tightened, there must be an even gap between the clamping flanges. If this is not the case, the gear unit must be dismantled and the shrink disc connection checked for correct fit.
11. The hollow shaft of the gear unit and the solid shaft of the machine should be marked with a line (felt-tip pen) in order to detect any slippage under load.

### Dismantling sequence:

1. Loosen the tensioning bolts successively in a clockwise direction by several turns with approx.  $\frac{1}{4}$  rotation per turn. Do not remove the bolts from their thread.
2. Loosen the clamping flanges from the cone of the inner ring.
3. Remove the gear unit from the solid shaft of the machine.

If a shrink disk has been in use for a long period or is dirty, it must be dismantled, cleaned and the conical surfaces coated with Molykote G Rapid Plus or a similar lubricant before it is refitted. The threads and head surfaces of the screws must be treated with grease without Molykote. Any damaged or corroded elements must be replaced.

### 3.12 Fitting the covers



#### DANGER!

#### Explosion hazard



Explosion hazard due to damaged and rubbing covers. Failure to comply may cause severe, or even fatal injuries.

- Damaged covers must not be used, as they may cause rubbing.
- Covers must be inspected for transportation damage e.g. dents and warping before they are fitted.



#### WARNING

#### Risk of injury

There is a danger of injury due to shrink discs and freely rotating shaft journals.

- Use a cover (Option H) as a guard.
- If this does not achieve sufficient protection against contact according to the required protection type, the machinery and plant constructor must ensure this by means of special attached components.

All fixing screws must be used and coated prior to use with a securing lubricant e.g. Loctite 242, Loxeal 54-03 and tightened to the correct torque (please see chapter 6.3 "Torque values"). For covers with Option H66, press in the new / new condition closing cap by tapping it lightly with a hammer.



Fig. 13: Fitting the covers, Option SH, Option H, and Option H66

### 3.13 Fitting a standard motor



#### DANGER!

#### Explosion hazard



Explosion hazard. Failure to comply may cause severe, or even fatal injuries.

- Only standard motors with an adequate ATEX Zone category according to the type plate may be used.
- In addition, for ATEX category 2D gear units (see the ATEX labelling on the last line of the gear unit type plate), the motor must have at least protection class IP6x.

The maximum permitted motor weights indicated in the table below must not be exceeded:

Maximum permitted motor weights														
IEC motor size	63	71	80	90	100	112	132	160	180	200	225	250	280	315
NEMA motor size		56C	143T	145T	182T	184T	210T	250T	280T	324T	326T	365T		
Max. motor weight [kg]	25	30	40	50	60	80	100	200	250	350	500	700	1000	1500



#### WARNING

#### Risk of injury

Severe injuries may be caused by rapidly rotating parts when installing and servicing couplings.

Secure the drive unit against accidental switch-on.

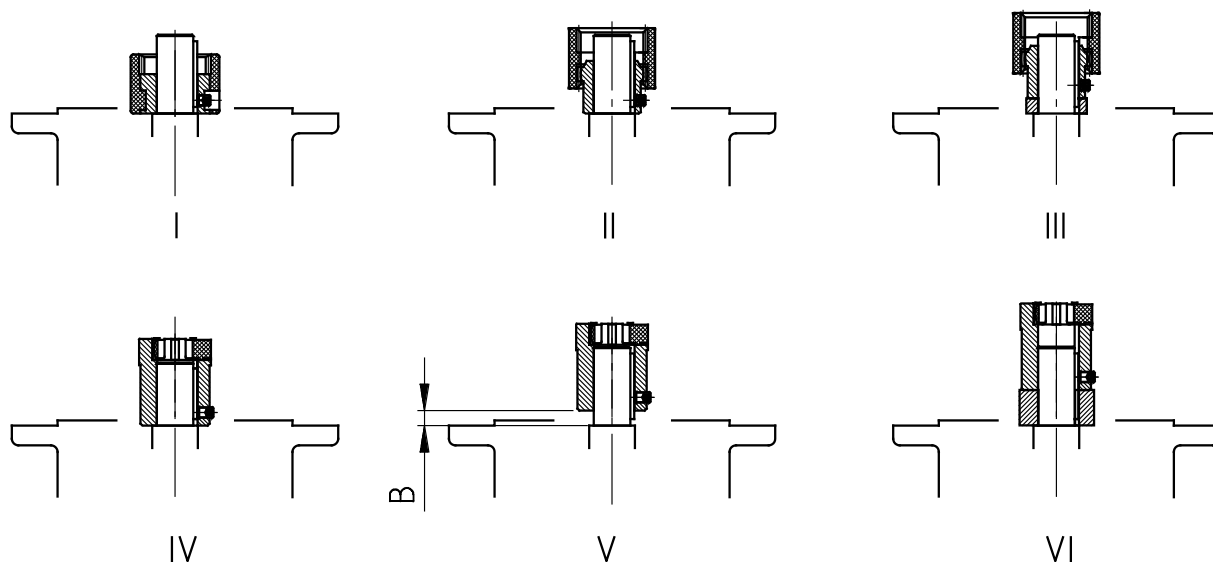
Gear units with IEC adapters must be operated with self-cooling motors compliant with IC411 (TEFC) or externally cooled IC416 (TEBC) motors compliant with EN60034-6 which generate a continuous flow of air in the direction of the gear unit. Please consult NORD if IC410 (TENV) motors without fans are to be used.

#### Assembly procedure to attach a standard motor to the IEC adapter (Option IEC) / NEMA adapter

1. Clean motor shaft and flange surfaces of motor and adapter and check for damage. The mounting dimensions and tolerances of the motor must conform to DIN EN 50347/NEMA MG1 Part 4.
2. Push the coupling sleeve onto the motor shaft so that the motor parallel key engages into the groove in the sleeve on tightening.
3. Tighten the coupling sleeve on the motor shaft in accordance with the motor manufacturer's instructions until it touches the collar. With motor sizes 90, 160, 180 and 225, any spacer bushes must be positioned between the coupling sleeve and the collar. With standard helical gear units, dimension B between the coupling sleeve and the collar must be observed (see Fig. 14). Certain **NEMA adapters** require the adjustment of the coupling in accordance with the specifications indicated on the adhesive plate.
4. If the coupling half contains a threaded pin, the coupling must be secured axially on the shaft. Prior to use, the threaded pin must be coated with a securing adhesive e.g. Loctite 242, Loxeal 54-03 and tightened to the correct torque (please see chapter 6.3 "Torque values").

### 3 Assembly instructions, storage, preparation, installation

5. **The flange surfaces** of motor and adapter must be completely coated with **surface sealant** e.g. Loctite 574 or Loxeal 58-14 prior to mounting the motor, so that the flange seals after mounting. (only necessary for category 2D gear units – see ATEX labelling on the last line of the gear unit type plate) Sealing of the flange surfaces is also recommended for installation outdoors or in damp environments.
6. Mount the motor to the adapter. Do not forget to fit the gear rim or the sleeve (see Fig. 14).
7. Tighten the bolts of the adapter with the correct torque (please see chapter 6.3 "Torque values").



**Fig. 14: Fitting the coupling onto the motor shaft - various types of coupling**

- I Curved tooth coupling (BoWex®) single part
- II Curved tooth coupling (BoWex®), two-part
- III Curved tooth coupling (BoWex®), two-part with spacer bush
- IV Claw coupling (ROTEX®), two-part
- V Claw coupling (ROTEX®), two-part, observe dimension B:

Standard helical gear unit:		
SK 0, SK 01, SK 20, SK 25, SK 30, SK 33 (2-stage)		
SK 010, SK 200, SK 250, SK 300, SK 330 (3-stage)		
	IEC size 63	IEC size 71
Dimension B (Fig. V)	B = 4.5 mm	B = 11.5 mm

- VI Claw coupling (ROTEX®), two-part with spacer bush

### 3.14 Fitting the cooling coil to the cooling system

#### **WARNING**

#### **Risk of injury**

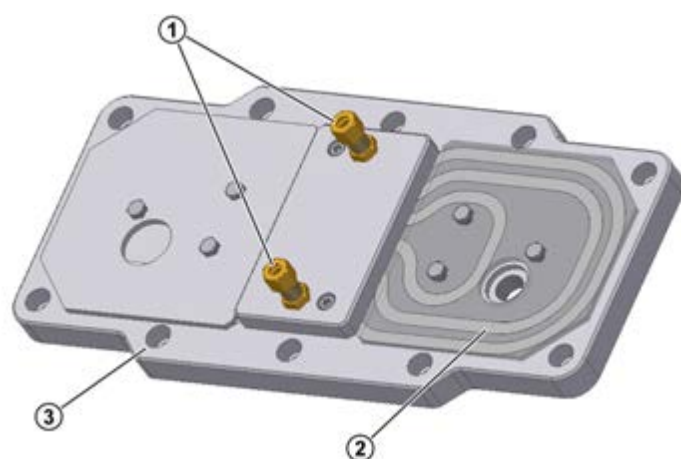
Possibility of injury due to pressure discharge.

The pressure released from the cooling circuit before carrying out any work on the gear unit.

The cooling coil is installed in the casing cover. Cutting ring screw threads according to DIN 2353 are located at the casing cover for the connection of a pipe with an external diameter of 10 mm.

**Remove the closing cap from the screw neck prior to assembly to avoid any contamination of the cooling system.** The screw necks should be connected with the coolant circuit, which must be provided by the operator. The flow direction of the coolant is irrelevant.

**Make sure not to twist the screw necks during or after assembly** as the cooling coil may be damaged. It must be ensured that no external forces act on the cooling coil.



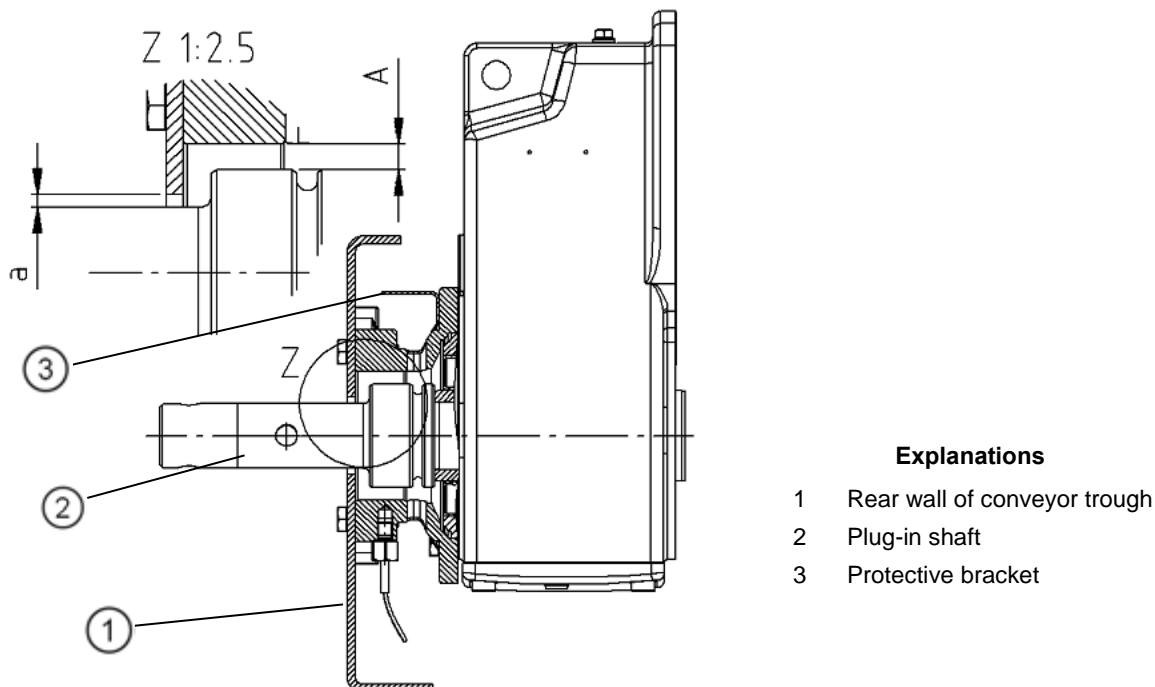
#### **Explanation**

- 1 Cutting ring screw threads
- 2 Cooling coil
- 3 Housing cover

**Fig. 15: Cooling cover**

### 3.15 Installation example for an SCX flange



Note that the maximum gap (dimension a) between the push-in shaft and the rear wall of the conveyor channel or the fastening plate must not exceed  $a = 8 \text{ mm}$ .



**Fig. 16: Installation example for an SCX flange**

Check the position of the protective bracket. The protective bracket must always cover the vertical open hole in the flange. The SCX flange may only be used in installation positions M1, M2, M3 and M4. A temperature sensor can be fitted as an option. The sensor must trigger at a temperature of  $120^{\circ}\text{C}$  and shut down the drive unit. Visual inspection is not required if a temperature sensor is used (please see chapter 5.1 "Service and Maintenance Intervals")

### 3.16 Temperature sticker

 <b>DANGER!</b>	<b>Explosion hazard</b>
	<p>Explosion hazard due to lack of labelling. Failure to comply may cause severe, or even fatal injuries.</p> <p>With temperature class T4 gear units with a maximum surface temperature of less than 135 °C, the supplied self-adhesive temperature sticker (printed with value 121 °C) must be affixed to the gear unit housing. (Part No. 2839050)</p>

The temperature class or the maximum surface temperature can be seen from the ATEX labelling in the last line of the type plate.

Examples: II 2G c IIC T4 X or II 3D 125 °C X

The temperature sticker must be affixed next to the oil level screw and (please see chapter 6.1 "Configurations and maintenance") towards the motor. For gear units with an oil level vessel, the temperature sticker must be affixed in the same position as for gear units without an oil level vessel. For gear units which are lubricated for life, without oil maintenance, the temperature sticker should be affixed next to the type plate.

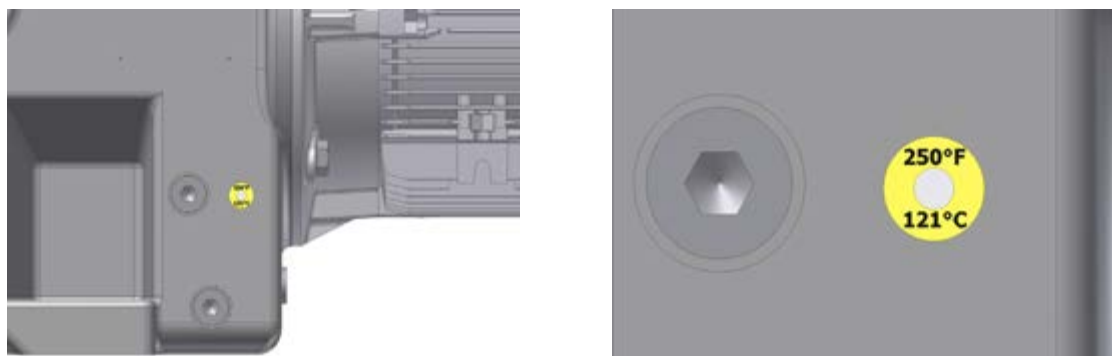


Fig. 17: Position of the temperature sticker

### 3.17 Subsequent paintwork

<b>NOTICE</b>	<b>Damage to the device</b>
	<p>For retrospective painting of the gear unit, the radial seals, rubber elements, pressure venting valves, hoses, type plates, adhesive labels and motor coupling components must not come into contact with paints, lacquers or solvents, as otherwise components may be damaged or made illegible.</p>

For subsequent painting, note that for use in Category II2G Group IIC the paint thickness must not exceed 0.2 mm.

## 4 Commissioning

### 4.1 Check the oil level



#### DANGER!

#### Explosion hazard



Explosion hazard. Failure to observe this may cause severe, or even fatal injuries.  
Before commissioning, the oil level must be checked with the supplied dipstick.



#### WARNING

#### Danger of burns

Danger of burns due to hot oil.

- Allow the gear unit to cool down before carrying out maintenance or repair work.
- Wear protective gloves.

The installation must comply with the configuration on the type plate. Section 6.1 "Configurations and maintenance" describes the configurations and the corresponding oil level screws. With double gear units, the oil level must be checked on both units. The vent must be in the position indicated in Section 6.1 "Configurations and maintenance".

The oil level does not need to be checked on gear units without oil level screw (please see chapter 6.1 "Configurations and maintenance").

Gear unit types that are not supplied full of oil must be filled before the oil level is checked. (please see chapter 5.2 "Service and Maintenance Work").

Check the oil level with an oil temperature of between 20°C to 40°C.

Checking the oil level:

1. The oil level may only be checked when the gear unit is at a standstill and has cooled down. The gear unit must be secured to prevent accidental switch-on.
2. Gear units with oil level screw:
  - Standard configuration M4 (V1 and V5) helical gear units have an angled pipe for checking the oil level as shown in Fig. 18 (right-hand illustration). This must point vertically upwards. Before checking the oil level, the pressure vent must be unscrewed.
  - Unscrew the oil level screw for the particular configuration (please see chapter 6.1 "Configurations and maintenance").
  - Check the oil level in the gear unit with the dipstick supplied (Part No.: 283 0050), as shown in Fig. 18 (left and right illustration). To do this, the part of the dipstick which is submerged in the oil must be held vertically.
  - The maximum oil level is the lower edge of the oil level hole.



- The minimum oil level is approx. 4 mm below the lower edge of the oil level hole. The dipstick then just dips into the oil.
- If the oil level is not correct, it must be adjusted by draining off oil or topping up with the type of oil stated on the type plate.
- If the screw lock coating in the thread of the oil drain screw or oil level screw is damaged, a new oil level screw must be used or the thread cleaned and coated with securing adhesive, e.g. Loctite 242, Loxeal 54-03 prior to insertion.
- Check the sealing ring for damage. Replace with a new sealing ring in case of damage.
- Fit the oil level screw together with the sealing ring and tighten to the correct torque (please see chapter 6.3 "Torque values").
- If the pressure vent has been unscrewed, reinsert it together with the sealing ring and tighten to the correct torque (please see chapter 6.3 "Torque values").

### 3. Gear units with an oil reservoir:

The oil level must be checked in the oil reservoir with the aid of the dipstick plug (thread G1 1/4). The oil level must be between the upper and lower marking when the dipstick is fully screwed in see Fig. 18 (centre illustration). These gearboxes may only be operated in the configuration stated in Section 6.1 "Configurations and maintenance".

### 4. Gear units with oil inspection glass:

- The oil level can be seen directly in the window
- The correct oil level is: the middle of the oil inspection glass.
- If the oil level is not correct, it must be adjusted by draining off oil or topping up with the type of oil stated on the type plate.

### 5. Final check:

- All previously removed screws must be screwed back in correctly.

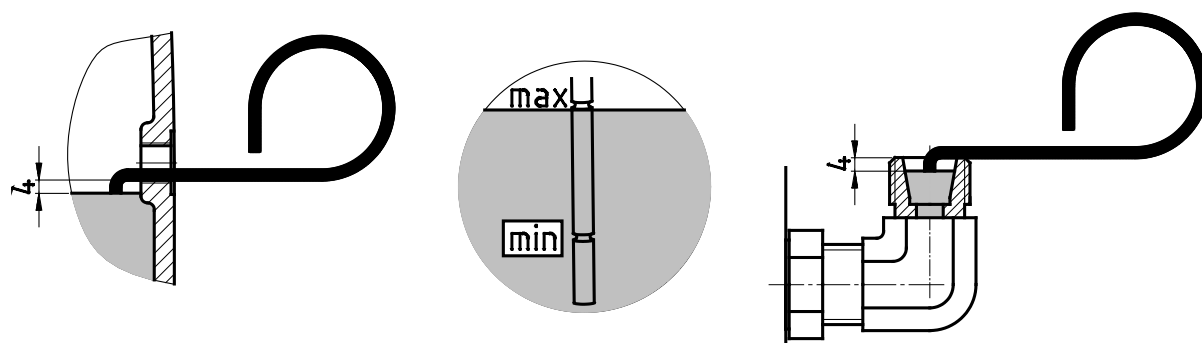


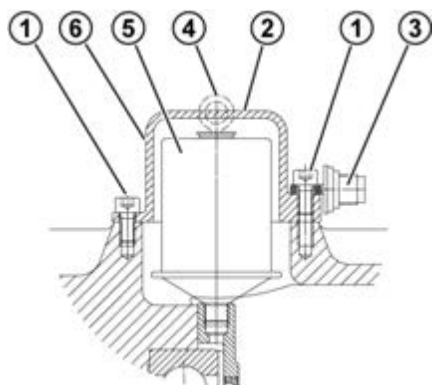
Fig. 18: Checking the oil level with a dipstick

## 4.2 Activating the Automatic Lubricant Dispenser

Some gear unit types with standard motor (Option IEC/NEMA) have an automatic lubricant dispenser for the roller bearings. This dispenser must be activated prior to commissioning. The cartridge case cover of the adapter for attaching an IEC / NEMA standard motor has a red information sign for the activation of the lubricant dispenser.

### Activating the Automatic Lubricant Dispenser:

1. Loosen and remove the cylindrical screws.
2. Remove the cartridge cover.
3. Screw the activation screw into the lubricant dispenser until the lug breaks off at the defined fracture point
4. The **flange surfaces** of the cartridge cover must be completely coated with **surface sealant** e.g. Loctite 574 or Loxeal 58-14 prior to assembly, so that the cover seals after it has been fitted. (Only necessary for Category 2D gear units – see ATEX labelling, last line of the type plate)
5. Re-fit the cartridge cover and fasten it with the cylindrical screw (please see chapter 6.3 "Torque values").
6. Mark activation date on the adhesive label indicating the month/year



#### Explanation

- |                            |   |
|----------------------------|---|
| 1<br>2<br>3<br>4<br>5<br>6 | Cylindrical screw M8 x 16<br>Cartridge cover<br>Activation screw<br>Lug<br>Lubricant sensor<br>Position of adhesive label |
|----------------------------|---|

Fig. 19: Activating the automatic lubricant dispenser with standard motor mounting



### Adhesive label:

<b>Notice!</b>																					
Screw in the activation screw until the lug breaks off before commissioning the gear unit.																					
Dispensing time: 12 Months																					
Month					Activation date										Year						
1	2	3	4	5	6	7	8	9	10	11	12	06	07	08	09	10	11	12	13	14	15

Fig. 20: Adhesive label



### 4.3 Temperature measurement

The details of the ATEX temperature class or the maximum surface temperature are based on normal installation conditions (please see chapter 3.7 "Preparing for installation"). Even small changes to the installation conditions can have a significant effect on the temperature of the gear unit.

 <b>DANGER!</b>	<b>Explosion hazard</b>
	<p>Explosion hazard. Failure to comply may cause severe, or even fatal injuries.</p> <p>On commissioning, a surface temperature measurement of the gear unit must be made under maximum load.</p> <p>(This does not apply to gear units which are labelled as temperature class T1 – T3 or a maximum surface temperature of 200 °C in the last line of the type plate.)</p>

For the temperature measurement, a normal temperature measuring device is required, with a measurement range from 0 °C to 130 °C and a precision of at least  $\pm 4$  °C and which enables the measurement of the surface temperature and the temperature of the air. Temperature measurement procedure:

1. Allow the gear unit to run at maximum speed under maximum load for approx. 4 hours.
2. Following warm-up, the temperature of the gear unit housing surface  $T_{gm}$  must be measured close to the temperature indication label (please see chapter 3.16 "Temperature sticker").
3. Measure the temperature of the air  $T_{um}$  in the immediate vicinity of the gear unit.

 <b>DANGER!</b>	<b>Explosion hazard</b>
	<p>Explosion hazard. Failure to comply may cause severe, or even fatal injuries.</p> <p>The gear unit must be shut down and Getriebebau NORD must be consulted if any of the following criteria do not apply:</p>

- The measured air temperature  $T_{um}$  is within the permissible range stated on the type plate.
- The measured temperature of the surface of the gear unit housing  $T_{gm}$  is below 121 °C and the temperature indication label has not turned black (see Fig. 22).
- The measured temperature of the surface of the gear unit housing plus the difference between the highest permissible air temperature  $T_u$  stated on the type plate and the measured air temperature must be at least 15 °C lower than the maximum permissible surface temperature, i.e.:

ATEX labelling: II 2G c T4 / II 3G T4 :	$T_{gm} + T_u - T_{um} < 135\text{ °C} - 15\text{ °C}$
ATEX labelling: II 2D c T <sub>max</sub> / II 3D T <sub>max</sub> :	$T_{gm} + T_u - T_{um} < T_{max} - 15\text{ °C}$
<p>T<sub>gm</sub>: Measured temperature of the surface of the gear unit housing in °C</p> <p>T<sub>um</sub>: Measured air temperature in °C</p> <p>T<sub>max</sub>: Maximum surface temperature according to gear unit type plate (ATEX labelling) in °C</p> <p>T<sub>u</sub>: Upper value of the permissible ambient temperature range according to the type plate in °C</p>	



Fig. 21: ATEX labelling


Centre dot is **white**: OK

Centre dot is **black**: Temperature was too high.

Fig. 22: Temperature sticker

#### 4.4 Operation with lubricant cooling

 <b>DANGER!</b>	<b>Explosion hazard</b>
	<p>Explosion hazard. Failure to comply may cause severe, or even fatal injuries.</p> <p>The temperature of the cooling water and the cooling water flow rate must be supervised and ensured by the operator.</p> <p>The ATEX approval is void if these instructions are not observed!</p>

<b>NOTICE</b>	<b>Gear unit damage</b>
<p>The gear unit may be damaged by overheating.</p> <p>The drive may only be commissioned after the cooling spiral has been connected to the cooling circuit, and the cooling circuit has been put into operation.</p>	

The coolant must have a similar thermal capacity as water (specific thermal capacity at 20 °C  $c=4.18 \text{ kJ/kgK}$ ). Industrial water without any air bubbles or sediments is recommended as a coolant. The hardness of the water must be between 1 dH and 15 dH; the pH value must be between pH 7.4 and pH 9.5. No aggressive liquids may be added to the coolant!

The **coolant pressure** must not exceed **8 bar**. The required **quantity of coolant** is **10 litres/minute**, and the **coolant inlet temperature** must not exceed 40°C; we recommend **10 °C**.

We also recommend fitting a pressure reducer or similar at the coolant inlet to avoid damage due to excessive pressure.

If there is a danger of frost the operator should add a suitable anti-freeze solution to the cooling water.

## 4.5 Checking the gear unit

During a test run under full load, the gear unit should be checked for:

- Unusual noises, such as grinding, knocking or rubbing noises
- Unusual vibrations, oscillations or other movements
- Production of steam or smoke

After the test run, the gear unit should be checked for:

- Leaks
- Slippage of the shrink disks. For this, the cover must be removed and a check carried out whether the marking described in Section 3.11 "Fitting shrink discs" shows a relative movement of the hollow shaft of the gear unit and the machine shaft. After this, the cover must be fitted as described in Section 3.12 "Fitting the covers".

### Information

### Lubrication of the shaft sealing rings

Shaft sealing rings are rubbing seals and have sealing lips made from an elastomer material. These sealing lips are lubricated with a special grease at the factory. This reduces the wear due to their function and ensures a long service life. An oil film in the region of the rubbing sealing lip is therefore normal and is not due to leakage.

### DANGER!

### Explosion hazard



Explosion hazard. Failure to comply may cause severe, or even fatal injuries.

The drive must be shut down and Getriebebau NORD consulted if any irregularities are observed during the checks described above.

## 4.6 Checklist

Checklist		
Subject of check	Date checked:	Information see Section
Is any transportation damage or damage apparent?		3.4
Does the labelling on the type plate conform to the specifications?		3.5
Does the configuration on the type plate conform to the actual installation?		3.6
Is the pressure vent screwed in?		3.7
Do all drive and driven elements have ATEX approval?		3.9
Are the external gear shaft forces within permitted limits (chain tension)?		3.9
Are contact guards fitted to rotating components?		3.12
Does the motor also have a relevant ATEX approval?		3.13
Is the temperature sticker affixed?		3.16
Has the correct oil level for the configuration been checked?		4.1
Is the automatic lubricant dispenser activated?		4.2
Has the temperature measurement been carried out?		4.3
Has the centre of the temperature sticker turned black?		4.3
Is the cooling cover connected to the cooling circuit?		3.14 4.4
Has the gear unit been checked with a test run?		4.5
Has the shrink disk connection been checked for slippage?		4.5

## 4.7 Operation of the gear unit in explosive areas



### DANGER!

### Explosion hazard



Explosion hazard. Failure to comply may cause severe, or even fatal injuries.

- When operating the gear unit, the instructions in this operating manual must be complied with.
- The prescribed inspection and servicing intervals must be complied with.
- It must be ensured that the power ratings stated on the type plate are not exceeded. If, e.g. for variable speed drive units, there are several operating points, the maximum permissible drive power P1 or the maximum permissible torque on the driven shaft M2 or the maximum permissible speed must not be exceeded at any operating point. Overload of the gear unit must be ruled out.
- If the gear unit is equipped with a cooling coil, it may only be put into operation if the cooling coil has been connected to the cooling circuit and the cooling circuit is in operation. The temperature of the cooling fluid and the cooling fluid flow rate must be monitored and ensured by the operator.
- Gear units with an integrated back stop on the drive shaft may only be operated at more than the minimum speed of the gear unit drive shaft,  $n_{1min} = 900$  rpm.
- The painting of the gear unit is designed for Category 2G Group IIB (Zone 1 Group IIB). **For use in Category 2G Group IIC (Zone 1 Group IIC)** the gear unit must not be used or installed in areas in which processes which cause electrostatic charging are to be expected. This also includes occasional manual rubbing of the gear unit housing; cleaning may only be carried out with a cloth which is moistened with water.
- During operation, if any of the irregularities described in Section 4.5 "Checking the gear unit" are detected, or the temperature sticker has turned black, the gear unit must be shut down and Getriebebau NORD must be consulted.

## 5 Service and maintenance



### WARNING

### Danger of burns

The surfaces of gear units or geared motors may become hot during or shortly after operation.

- Installation and maintenance work must only be performed when gear unit is at a standstill and has cooled down. The drive must be isolated and secured to prevent accidental start-up.
- Wear protective gloves.
- Shield hot surfaces with contact guards.

### 5.1 Service and Maintenance Intervals

Service and Maintenance Intervals	Service and Maintenance Work	Information see Section
Weekly or every 100 operating hours	<ul style="list-style-type: none"> <li>• Visual inspection for leaks</li> <li>• Check the gear unit for unusual running noises and/or vibrations</li> <li>• Only for <b>gear units with cooling cover</b>: Visual inspection of the temperature sticker</li> </ul>	5.2
Every 2500 operating hours, at least every six months	<ul style="list-style-type: none"> <li>• Check the oil level</li> </ul>	4.1
	<ul style="list-style-type: none"> <li>• Visual inspection of the rubber buffer</li> <li>• Visual inspection of hose</li> <li>• Visual inspection of shaft sealing ring</li> <li>• Visual inspection of Option SCX</li> </ul>	5.2
	<ul style="list-style-type: none"> <li>• Visual inspection of the temperature sticker</li> </ul>	5.2 4.3
	<ul style="list-style-type: none"> <li>• Remove dust (only for category 2D)</li> <li>• Check coupling (Only for category 2G and standard IEC / NEMA motor attachment)</li> <li>• Re-grease / remove excess grease (only applicable for free drive shaft / Option W and for agitator bearings / Option VL2 / VL3)</li> <li>• Clean or replace the pressure venting screw</li> </ul>	5.2



## Explosion-protected gear units – Operating and Assembly Instructions

Service and Maintenance Intervals	Service and Maintenance Work	Information see Section
Every 5000 operating hours, at least every year (Only for standard IEC/NEMA motor attachment)	<ul style="list-style-type: none"> <li>Replace the automatic lubricant dispenser / remove excess grease</li> </ul>	5.2 4.2
For operating temperatures up to 80 °C. Every 10000 operating hours, at least every 2 years	<ul style="list-style-type: none"> <li>Change the oil (The interval is doubled if filled with synthetic products)</li> <li>Check the cooling coil for deposits (fouling)</li> <li>Replace shaft sealing rings if worn</li> </ul>	5.2
Every 20000 operating hours, at least every 4 years	- Re-lubrication of the bearings in the gear unit	5.2
According to the interval specified in field MI of the type plate at least every 10 years (Only for Category 2G and 2D)	- General overhaul	5.2



### Information

### Oil change intervals

The oil change intervals apply for normal operating conditions and operating temperatures up to 80°C. The oil change intervals are reduced in the case of extreme conditions (operating temperatures higher than 80°C, high humidity, aggressive environment and frequent fluctuations in the operating temperature).

## 5.2 Service and Maintenance Work



### DANGER!

### Explosion hazard



Explosion hazard. Failure to comply may cause severe, or even fatal injuries.

- No explosive atmosphere must be present during servicing and repair work. Servicing and maintenance work must only be performed by qualified specialist personnel.
- When cleaning the gear unit, do not use procedures or materials which may cause electrostatic charging of the gear unit or adjacent non-conducting components.



### WARNING

### Severe personal injury

Severe injury and material damage may be caused by incorrect servicing and maintenance work.

Servicing and maintenance work must only be performed by qualified specialist personnel. Wear the necessary protective clothing for servicing and maintenance work (e.g. industrial footwear, protective gloves, goggles, etc.)


**WARNING**
**Severe personal injury**

Risk of injury due to rapidly rotating and hot machine components.

Installation and maintenance work must only be performed when gear units are at a standstill and have cooled down. The drive must be isolated and secured to prevent accidental start-up.


**WARNING**
**Severe personal injury**

Particles or liquids thrown up during servicing and maintenance can cause injuries.

- Observe the safety information
- Pressure washers and compressed air must not be used for cleaning


**WARNING**
**Danger of burns**

Danger of burns due to hot oil.

- Allow the gear unit to cool down before carrying out maintenance or repair work.
- Wear protective gloves.

**Visual inspection for leaks**

**DANGER!**
**Explosion hazard**


Explosion hazard. Failure to comply may cause severe, or even fatal injuries.

- The gear unit must be checked for leaks. Attention should be paid to escaping gear oil and traces of oil on the exterior or underneath the gear unit. In particular, the radial seals, cover caps, screw plugs, hoses and housing joints should be checked.

If leaks are suspected, the gear unit should be cleaned, the oil level checked (please see chapter 4.1 "Check the oil level") and checked again for leaks after approx. 24 hours. If a leak is confirmed (dripped oil), the gear unit must be repaired immediately. Please contact the NORD service department.

If the gear unit is equipped with a cooling coil in the housing cover, the connections and the cooling coil must be checked for leaks. If there are any leaks, these must be repaired immediately. Please contact the NORD service department.

**Check for running noises**

**DANGER!**
**Explosion hazard**


Explosion hazard. Failure to comply may cause severe, or even fatal injuries.

- If the gear unit produces unusual running noises and/or vibrations, this could indicate damage to the gear unit. In this case the gear should be shut down and a general overhaul carried out.

## Check the oil level

(please see chapter 4.1 "Check the oil level").

## Visual inspection of the rubber buffer

Gear units with rubber buffers (Option G or VG) and gear units with torque supports are equipped with rubber elements. If these show damage such as tears to the rubber surface, the elements must be replaced. Please contact the NORD service department.

## Visual inspection of hose

Gear units with an oil reservoir (Option OT) have rubber hoses. If damage to the external surface of the hoses as far as where they are inserted occurs, e.g. due to abrasions, cuts or tears, they must be replaced. Please contact the NORD service department.

## Visual inspection of shaft sealing ring



### Information

### Shaft sealing rings

Shaft sealing rings are rubbing seals and have sealing lips made from an elastomer material. These sealing lips are lubricated with a special grease at the factory. This reduces the wear due to their function and ensures a long service life. An oil film in the region of the rubbing sealing lip is therefore normal and is not due to leakage (please see chapter 6.5 "Leaks and seals").

## Visual inspection of Option SCX

Check the dirt outlet holes on the flange for dirt. The gap between the shaft and the fastening plate must be free from dirt. If severe soiling is apparent, pull the gear unit off the push-in shaft and clean the push-in shaft and the inside of the flange. Check the shaft sealing ring on the gear unit for damage. Damage shaft sealing rings must be replaced with new rings. Mount the gear unit on the cleaned flange (please see chapter 3.10 "Fitting push-on gear units").

## Visual inspection of the temperature sticker

(Only necessary for temperature class T4 or max. surface temperature < 135 °C)



### DANGER!

### Explosion hazard



Explosion hazard. Failure to comply may cause severe, or even fatal injuries.

- Check whether the temperature sticker has turned black (please see chapter 3.16 "Temperature sticker"). If the temperature sticker has turned black, the gear unit has become too hot.

The cause of overheating must be established. Please contact the NORD service department immediately. The drive unit must not resume operation before the cause of overheating has been remedied and renewed overheating can be ruled out.

## 5 Service and maintenance

Before recommissioning, a new temperature sticker must be affixed to the gear unit (please see chapter 3.16 "Temperature sticker").

### Remove dust

(Only necessary for Category 2D)

### **DANGER!**

### Explosion hazard



Explosion hazard. Failure to comply may cause severe, or even fatal injuries.

- Dust deposits on the gear unit housing must be removed if they are more than 5 mm thick.

For gear units fitted with a cover (Option H), remove the cover. Dust deposits in the cover cap, on the output shaft and on the shrink disk must be removed. Then fit the cover cap (please see chapter 3.12 "Fitting the covers").

### **Information**

### Cover caps

Some cover caps can be completely sealed with liquid sealing agent. In such cases, there is no need for regular cleaning of the covering cap if it is completely sealed with a liquid sealing agent such as Loctite 574 or Loxeal 58-14.

### Checking the coupling

(Only necessary for Category 2G and IEC / NEMA standard motor attachments)

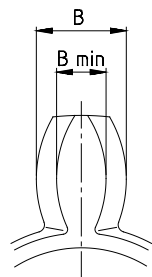
The motor must be removed. Plastic or elastomer coupling components must be examined for traces of wear. If the limiting values listed below for the particular coupling versions and sizes are exceeded, the plastic or elastomer coupling components must be replaced.

### **NOTICE**

### Replacement parts

Only use replacement parts with the same colour.

With claw couplings (ROTEX®) the tooth thickness of the elastomer gear rim must be measured as shown in the illustration.  $B_{min}$  is the minimum permitted tooth thickness.



**Fig. 23: Measurement of gear rim wearing on the ROTEX claw coupling®**

Limiting wear values for coupling gear rims							
Type	R14	R24	R38	R42	R48	R65	R90
B [mm]	9.7	8.6	13.3	15.7	17.7	22.2	32.3
B <sub>min</sub> [mm]	7.7	5.6	10.3	11.7	13.7	17.2	24.3

Table 12: Limiting wear values for coupling gear rims

For gear couplings, the limiting wear value is  $X = 0.8$  mm, as shown in the following illustration.

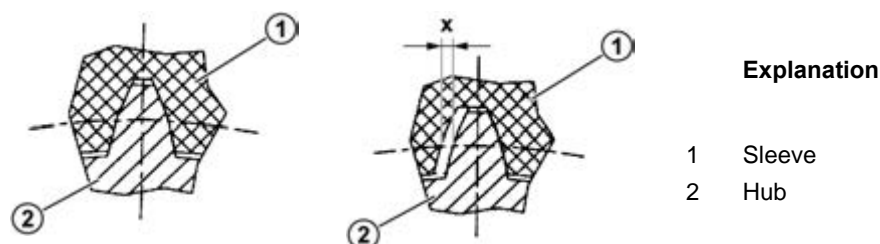


Fig. 24: Measurement of gear sleeve wear for gear BoWex couplings®

## Information

## Coupling wear

If the examination only shows slight wear (25 % of the limiting value), it is permissible to extend the interval for examination of the coupling to twice the normal period, i.e. 5000 operating hours and at least every year.

## Re-grease

Some gear unit designs (free drive shaft, Option W, agitator designs VL2 and VL3) are equipped with a re-greasing device.

For agitator versions VL2 and VL3, the vent screw located opposite to the grease nipple must be unscrewed before re-greasing. Grease should be injected until a quantity of 20 - 25 g escapes from the vent hole. After this, the vent plug must be reinserted and tightened.

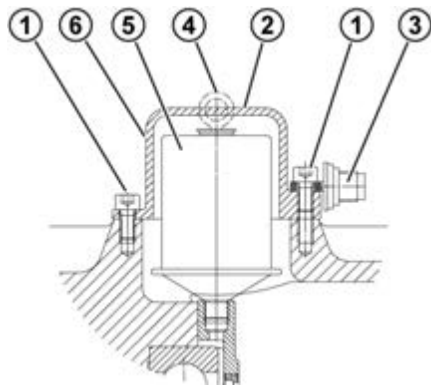
For Option W and some IEC adapters, the outer roller bearing must be re-greased with approx. 20 - 25 g of grease via the grease nipple provided. Excess grease must be removed from the adapter.

Recommended grease: Petamo GHY 133N (please see chapter 6.2 "Lubricants"), (Klüber Lubrication)

### Cleaning or replacing the vent screw

Unscrew the pressure vent, thoroughly clean the vent screw (e.g. with compressed air) carry out a function test and fit the vent screw in the same place. If necessary, use a new vent screw.

### Replacing the automatic lubricant dispenser



#### Explanation

- 1 Cylindrical screws M8 x 16
- 2 Cartridge cover
- 3 Activation screw
- 4 Lug
- 5 Lubricant sensor
- 6 Position of adhesive label

**Fig. 25: Replacing the automatic lubricant dispenser with standard motor mounting**

The cartridge cover must be unscrewed. Unscrew the lubrication dispenser and replace it with a new component (Part No. 283 0100). Excess grease must be removed from the adapter. Then carry out activation (please see chapter 4.2 "Activating the Automatic Lubricant Dispenser").

## Change the oil

The illustrations in Section 6.1 "Configurations and maintenance" show the oil drain screw, the oil level screw and the pressure vent screw (if fitted) for various designs.

Procedure:

1. Place the drip tray below the oil drain screw
2. Completely remove oil level screw, screwed sealing plug with dipstick if an oil level tank is being used and oil drain screw.



### WARNING

### Danger of burns

Danger of burns due to hot oil.

- Allow the gear unit to cool down before carrying out maintenance or repair work.
- Wear protective gloves.

3. Drain all the oil from the gear unit.
4. If the sealing ring of the oil drain screw or oil level screw is damaged, a new oil level screw must be used or the thread cleaned and coated with securing adhesive, e.g. Loctite 242, Loxeal 54-03 prior to insertion.
5. Insert the oil drain screw into the hole and tighten to the correct torque (please see chapter 6.3 "Torque values").
6. Using a suitable filling device, refill with **oil of the same type** (please see chapter 3.5 "Checking the type plate data") and (please see chapter 6.2 "Lubricants") through the oil level hole until oil emerges from the oil level hole. (The oil can also be filled through the pressure vent screw or a sealing plug located higher than the oil level). If an oil level vessel is used, fill the oil through the upper inlet (thread G1¼) until the oil level is set as described in Section 4.1 "Check the oil level"
7. Wait at least 15 minutes, or at least 30 minutes if an oil level tank is used, and then check the oil level. Proceed as described in Section 4.1 "Check the oil level".



### Information

### Oil level / Oil fill quantities

The oil does not need to be changed in gear units without an oil drain screw (please see chapter 6.1 "Configurations and maintenance"). These gear units are lubricated for life.

Standard helical gear units in ATEX category 3G and 3D (please see chapter 3.5 "Checking the type plate data") do not have an oil level screw. Here, the oil is topped up through the threaded pressure vent bolt using the quantities listed in the table in the following table.



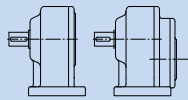


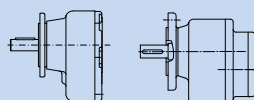
Oil fill volumes													
  Section 6.1							  Section 6.1						
	M1	M2	M3	M4	M5	M6		M1	M2	M3	M4	M5	M6
Gear unit type	Quantity [l]						Gear unit type	Quantity [l]					
<b>SK 0</b>	0.13	0.22	0.13	0.22	0.13	0.13	<b>SK 0 F</b>	0.13	0.22	0.13	0.22	0.13	0.13
<b>SK 01</b>	0.22	0.38	0.22	0.38	0.22	0.22	<b>SK 01 F</b>	0.22	0.38	0.22	0.38	0.22	0.22
<b>SK 20</b>	0.55	1.00	0.55	1.00	0.55	0.55	<b>SK 20 F</b>	0.35	0.60	0.35	0.60	0.35	0.35
<b>SK 25</b>	0.50	1.00	0.50	1.00	0.50	0.50	<b>SK 25 F</b>	0.50	1.00	0.50	1.00	0.50	0.50
<b>SK 30</b>	0.90	1.30	0.90	1.30	0.90	0.90	<b>SK 30 F</b>	0.70	1.10	0.70	1.10	0.70	0.70
<b>SK 33</b>	1.00	1.60	1.00	1.60	1.00	1.00	<b>SK 33 F</b>	1.00	1.50	1.00	1.50	1.00	1.00
<b>SK 000</b>	0.24	0.40	0.24	0.41	0.24	0.24	<b>SK 000 F</b>	0.24	0.41	0.24	0.41	0.24	0.24
<b>SK 010</b>	0.38	0.60	0.38	0.60	0.38	0.38	<b>SK 010 F</b>	0.35	0.65	0.40	0.74	0.50	0.30
<b>SK 200</b>	0.80	1.30	0.80	1.30	0.80	0.80	<b>SK 200 F</b>	0.65	0.95	0.70	1.10	0.80	0.50
<b>SK 250</b>	1.20	1.50	1.20	1.50	1.20	1.20	<b>SK 250 F</b>	0.90	1.40	1.00	1.60	1.30	0.80
<b>SK 300</b>	1.20	2.00	1.20	2.00	1.20	1.20	<b>SK 300 F</b>	1.25	1.50	1.20	1.80	1.30	0.95
<b>SK 330</b>	1.80	2.80	1.80	2.80	1.80	1.80	<b>SK 330 F</b>	1.60	2.50	1.60	2.90	1.90	1.40

Table 13: Oil fill quantities for standard helical gear units for ATEX category 3G and 3D

### Checking the cooling coil for deposits

The inner surface of the cooling coil must be checked for deposits, as in case of severe deposits (fouling) the dissipation of heat is no longer guaranteed. In this case, the cooling coil must be cleaned. If a chemical cleaner is used, it must be ensured that the cleaning agent does not attack the material of the cooling coil (Copper pipe and yellow brass fittings).

### Replacing the shaft sealing ring

Once the shaft sealing ring has reached the end of its service life, the oil film in the region of the sealing lip increases and a measurable leakage with dripping oil occurs.



**The shaft sealing ring must then be replaced.** The space between the sealing lip and the protective lip must be filled approximately 50 % with grease on fitting (recommended grease: PETAMO GHY 133N).

Take care that after fitting, the new shaft sealing ring does not run in the old wear track.

### Re-lubricating bearings

For bearings which are not oil-lubricated and whose holes are completely above the oil level, replace the roller bearing grease (recommended grease: PETAMO GHY 133N). Please contact the NORD service department.

### General overhaul

With Category 2G and 2D gear units, a general overhaul is necessary after a specified longer period of operation. The specification of the operating period in terms of operating hours, after which a general overhaul must be carried out, can be seen from the type plate data in field MI.

Alternatively, the maintenance class  $C_M$  can be used to determine the operating period after which a general overhaul must be carried out. The data in field MI of the type plate is then e.g.: MI  $C_M = 5$ .

The time for the general overhaul with the stated maintenance class  $C_M$  is calculated as follows:

$$N_A = C_M \cdot f_L \cdot k_A$$

$N_A$ : Number of years since commissioning. With calculated values of  $N_A$  which exceed 10 years, a general overhaul is due 10 years after commissioning.

$C_M$ : Maintenance class according to field MI of the type plate

$f_L$ : Running time factor

$f_L = 10$  Running time maximum 2 hours per day

$f_L = 6$  Running time 2 to 4 hours per day

$f_L = 3$  Running time 4 to 8 hours per day

$f_L = 1.5$  Running time 8 to 16 hours per day

$f_L = 1$  Running time 16 to 24 hours per day

$k_A$ : Utilisation factor

If the utilisation factor is not known,  $k_A = 1$

## 5 Service and maintenance

Longer maintenance intervals often result if the actual power required by the application is known. The utilisation factor may be calculated as follows:

$$k_A = \left( \frac{P_1}{P_{tat}} \right)^3$$

P<sub>1</sub> Max. permissible drive power or motor power in kW according to the type plate

P<sub>tat</sub>: Actual drive power or motor power in kW which is required by the application at the nominal speed. This is determined e.g. by measurements.

For variable loads with differing actual drive powers with nominal speeds P<sub>tat1</sub>, P<sub>tat2</sub>, P<sub>tat3</sub>, ... with known percentage times q<sub>1</sub>, q<sub>2</sub>, q<sub>3</sub>, ..., the following equivalent average drive power applies:

$$P_{tat} = \sqrt[3]{P_{tat1}^3 \cdot \frac{q_1}{100} + P_{tat2}^3 \cdot \frac{q_2}{100} + P_{tat3}^3 \cdot \frac{q_3}{100} + \dots}$$

### DANGER!

### Explosion hazard



Explosion hazard. Failure to comply may cause severe, or even fatal injuries.

- The general overhaul must be carried out by qualified personnel in a specialist workshop with appropriate equipment in observance of national regulations and laws. We urgently recommend that the general overhaul is carried out by NORD Service.

If a general overhaul is due, the gear unit must be completely dismantled. The following work must be carried out:

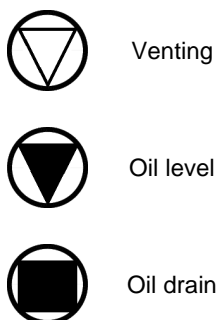
- Clean all gear unit components
- Examine all gear unit components for damage
- All damaged components must be replaced
- All roller bearings must be replaced
- Replace back stops if fitted
- Replace all seals, radial seals and Nilos rings
- Replace plastic and elastomer components of the motor coupling

## 6 Appendix

### 6.1 Configurations and maintenance

For configurations which are not listed, please refer to the special documentation drawing (please see chapter 3.5 "Checking the type plate data").

Explanation of symbols for the following version illustrations:



#### Standard helical gear units

Standard ATEX category 3G and 3D helical gear units do not have oil filling screws (please see chapter 3.5 "Checking the type plate data").

#### Parallel shaft gear units

The following illustration applies for the M4 / H5 configuration of gear unit types SK 9282, SK 9382, SK 10282, SK 10382, SK 11282, SK 11382, SK 12382 with oil reservoir.

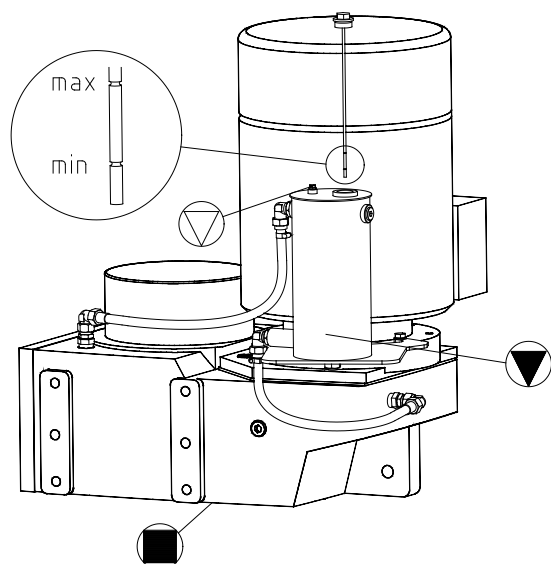


Fig. 26: Parallel shaft gear units with oil reservoir

Oil level screws are not fitted to gear unit types SK 0182 NB, SK 0282 NB and SK 1382 NB in the ATEX Categories 3G and 3D (please see chapter 3.5 "Checking the type plate data").

In Category 2G and 2D, types SK 0182 NB, SK 0282 NB and SK 1382 NB only have one oil level screw. These gear unit types have checkable life-long lubrication.

### NORDBLOC helical gear units

Gear unit types SK 320, SK 172, SK 272, SK 372 and SK 273 and SK373 are not fitted with oil level screws for ATEX Categories 3G and 3D (please see chapter 3.5 "Checking the type plate data").

In Category 2G and 2D, types SK 320, SK 172, SK 272, SK 372 and SK 273 and SK 373 only have one oil level screw. These gear unit types have checkable life-long lubrication.

### NORDBLOC helical gear units SK072.1 and SK172.1

## ⚠ DANGER!

## Explosion hazard



Explosion hazard. Failure to comply may cause severe, or even fatal injuries.

Checking the oil level in configuration M4 for SK 072.1 and SK 172.1:

The oil level check for the M4 installation orientation must be carried out as follows in the installation orientation M2:

1. Bring the gear unit into the M2 installation orientation and remove the oil level screw for the M2 orientation.

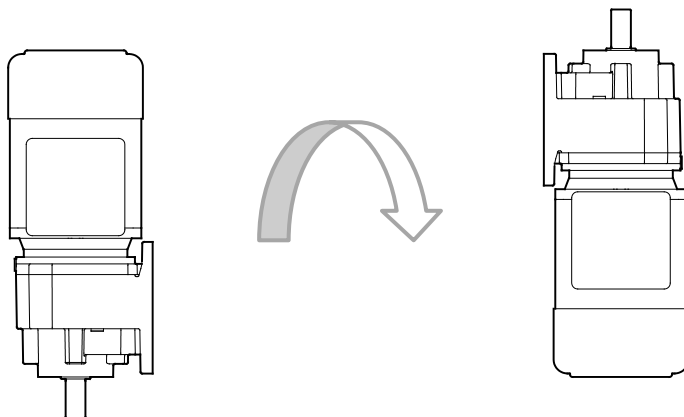
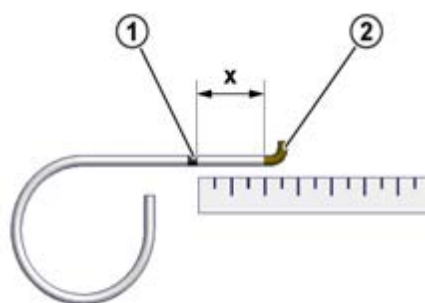
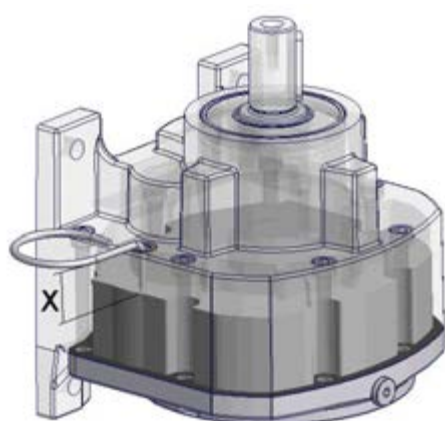


Fig. 27: Bring the gear unit into the M2 installation orientation

2. Determine the measurement X between the upper edge of the gear unit housing and the oil level. If necessary, modify the dipstick (see Fig. 28 below).



#### Explanation

- 1 Upper edge of housing
- 2 Oil level

**Fig. 28: Measuring the oil level**

3. Compare the determined measurement X with the corresponding measurement in the following table. If necessary, adjust the oil level with the type of oil shown on the type plate.

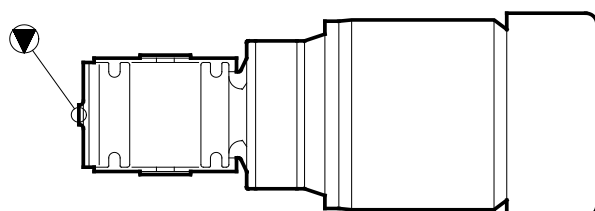
Gear unit type	Thread size	Measurement X [mm]
SK 072.1	M8 x 1	22 ± 1 mm
SK 172.1	M8 x 1	20 ± 1 mm

4. Screw in and tighten the oil level screw for the M2 installation position as described in Section 4.1 "Check the oil level".
5. Bring the gear unit back into the installation orientation M4.

#### UNIVERSAL worm gear units

SK 1SI 31 – SK 1SI 75

SK 1SIS 31 – SK 1SIS 75



**Fig. 29: Orientation for oil level check**

For the **oil level check**, the gear unit or the geared motor must be brought into the orientation shown above. To do this, it may be necessary to remove the gear unit or the geared motor.

## NOTICE

## Settling time



An adequate settling time of the worm gear unit in the position shown in Fig. 29 must be observed, in order to allow the oil to settle evenly.

The oil level can then be checked as described in Section 4.1 "Check the oil level".

In Category 2G and 2D the gear units only have one oil level screw. These gear unit types have a checkable life-long lubrication.

ATEX category 3G and 3D helical gear units do not have oil filling screws (please see chapter 3.5 "Checking the type plate data"). These gear unit types are lubricated for life.

The gear unit types **SK 1S xx**, **SK 2S xx**, **SK 1SU xx**, **SK 2SU xx**, **SK 1SM xx**, **SK 2SM xx**, **SK 1SMI xx**, **SK 2SMI xx** may only be used in category 3G and 3D. These gear unit types are lubricated for life and do not have an oil maintenance screw.

As an option, types SI and SMI can be equipped with a vent screw. Gear units with vents must be installed in the stated position.

Types SI, SMI, S, SM and SU as 2-stage gear unit types and types SI, SMI as worm gear units for direct motor mounting have an oil filler which depends on the configuration and must be installed in the stated position.

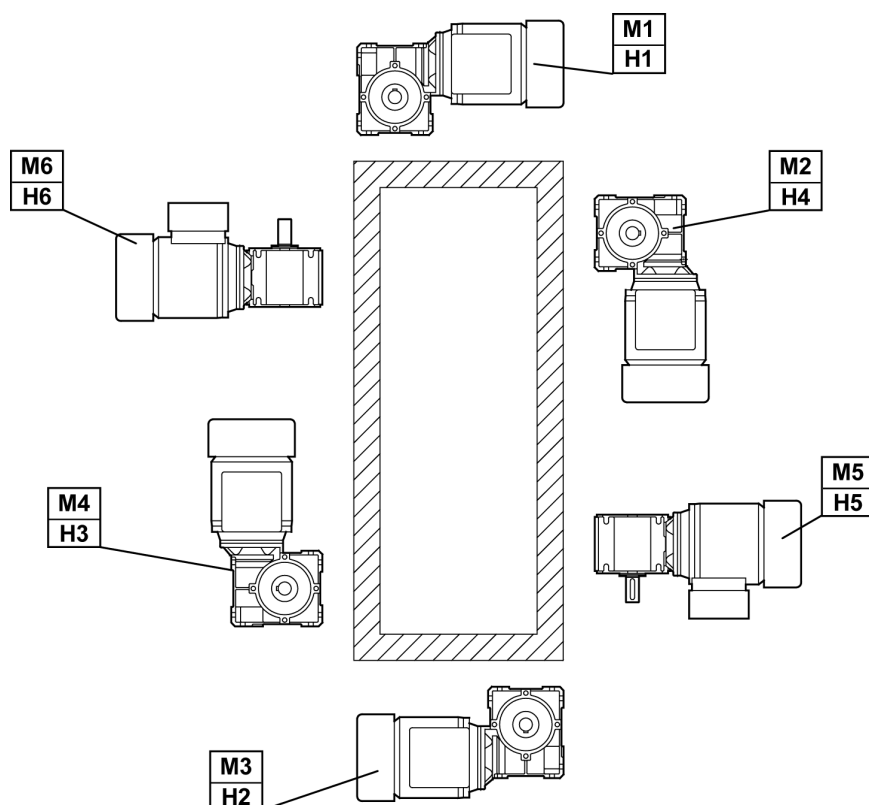
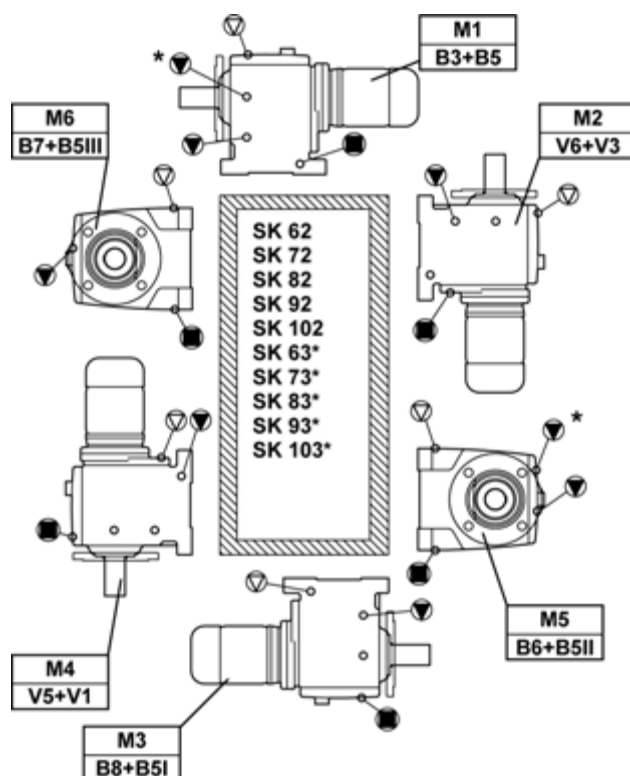
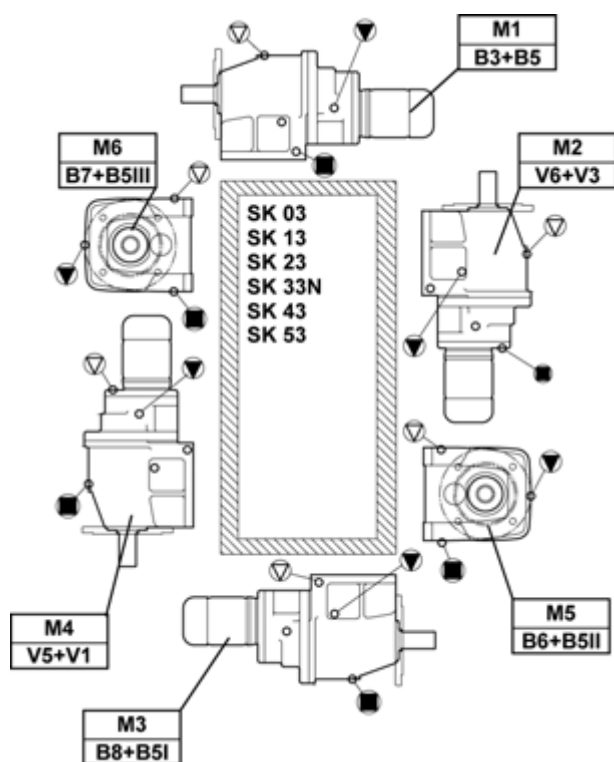
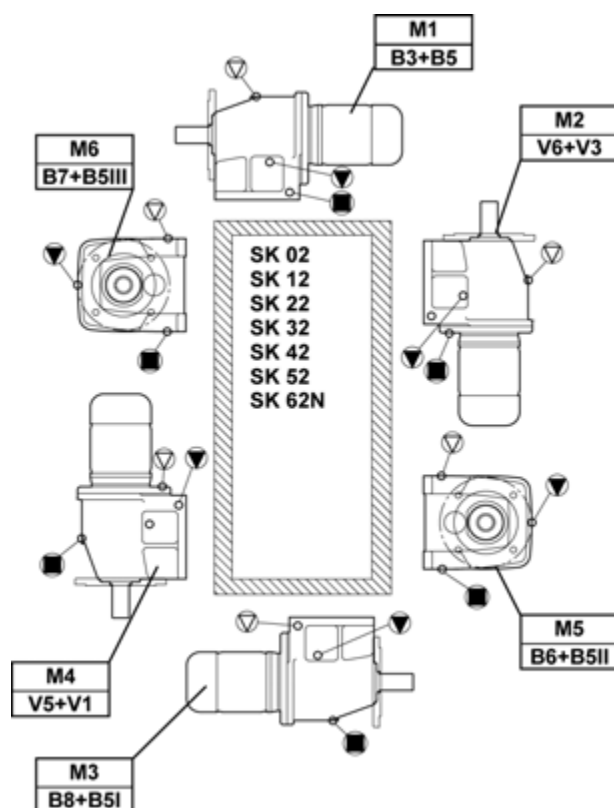
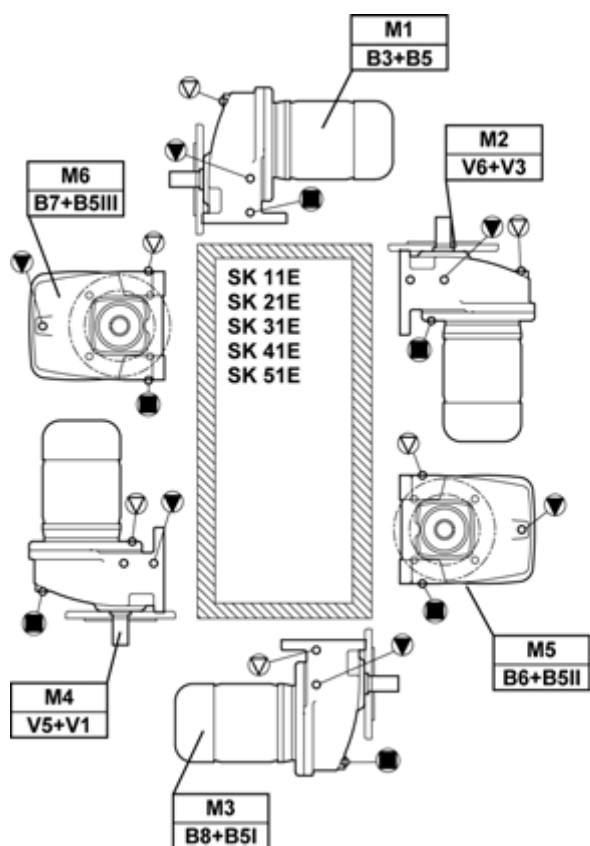
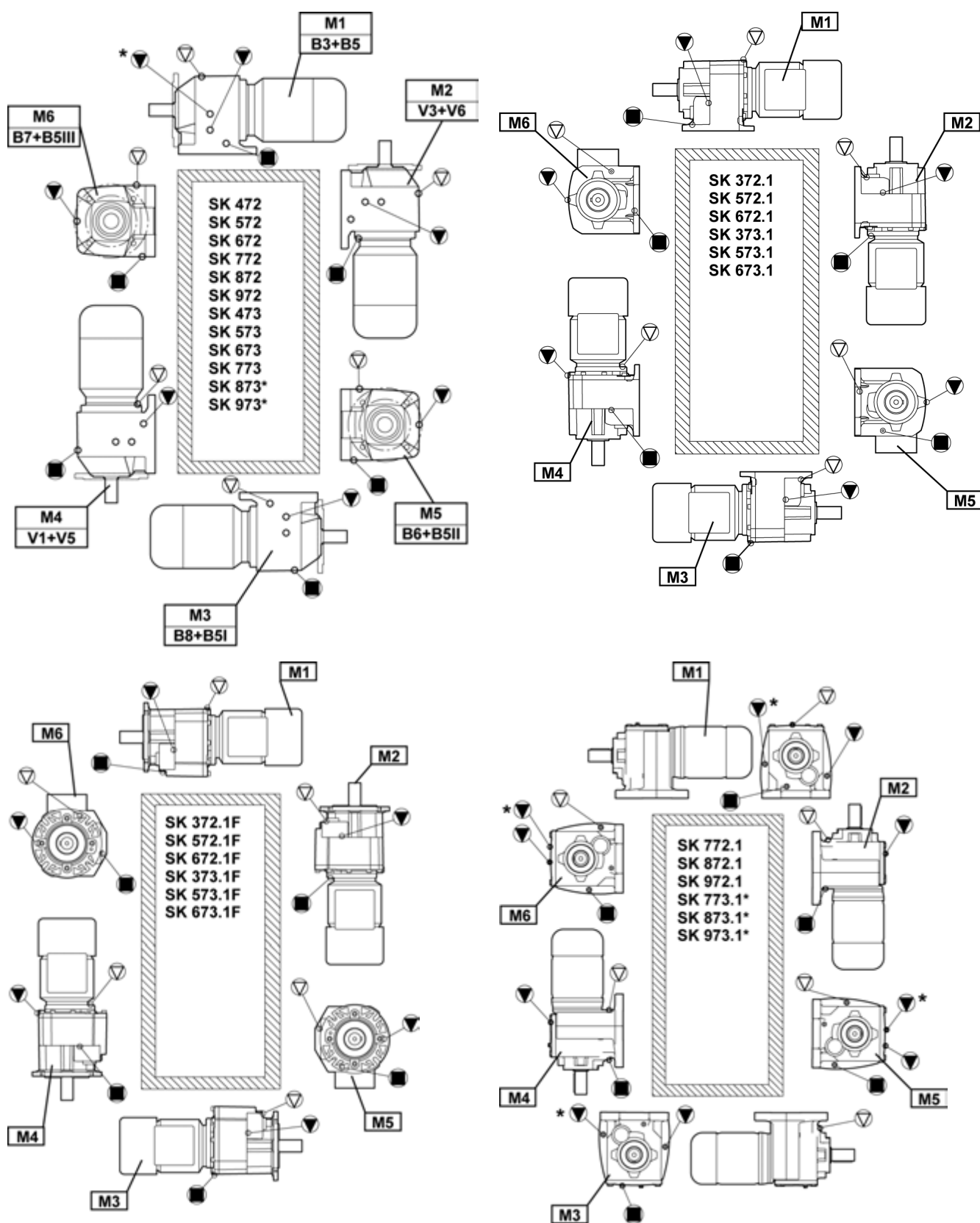


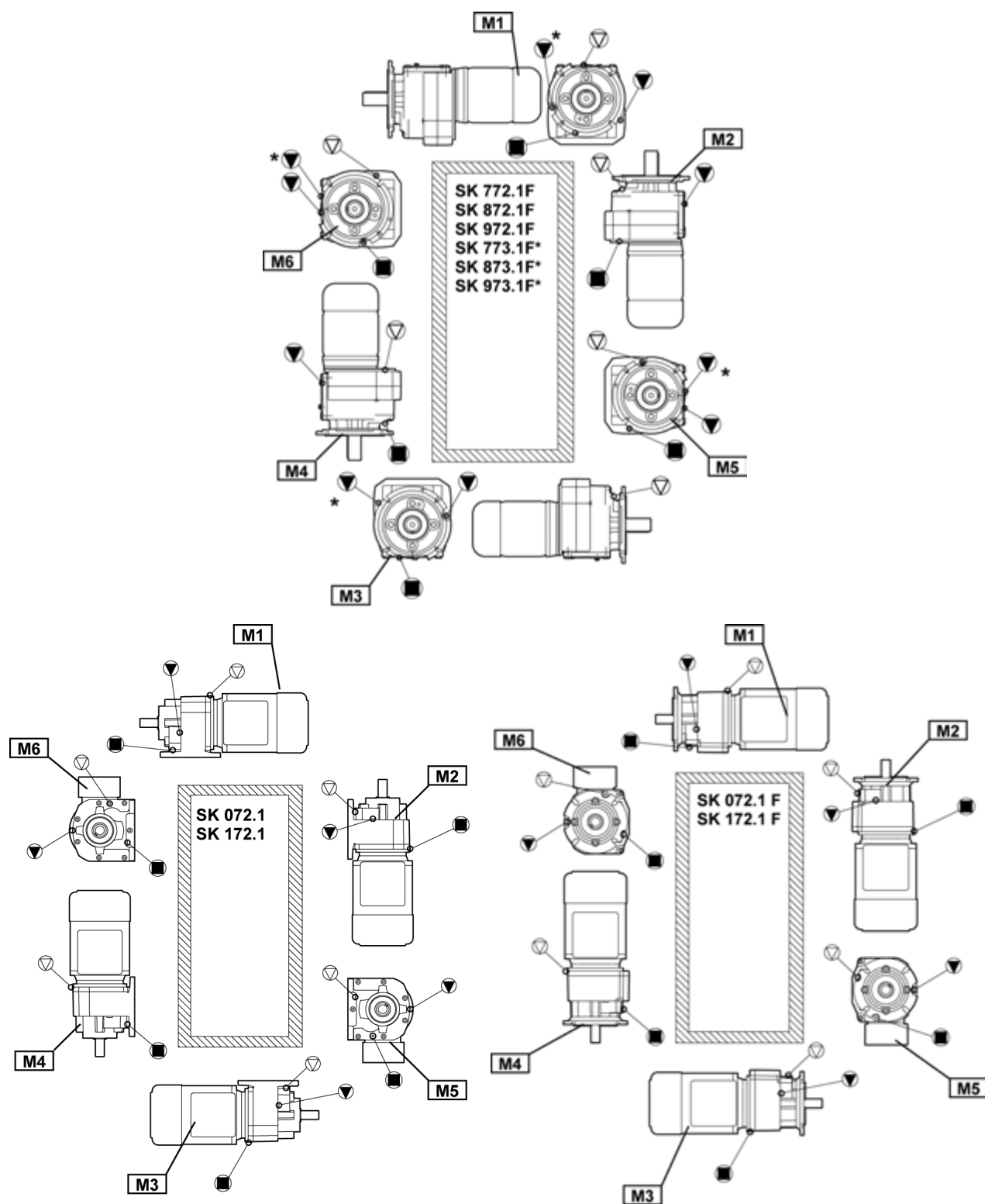
Fig. 30: UNIVERSAL worm gear units

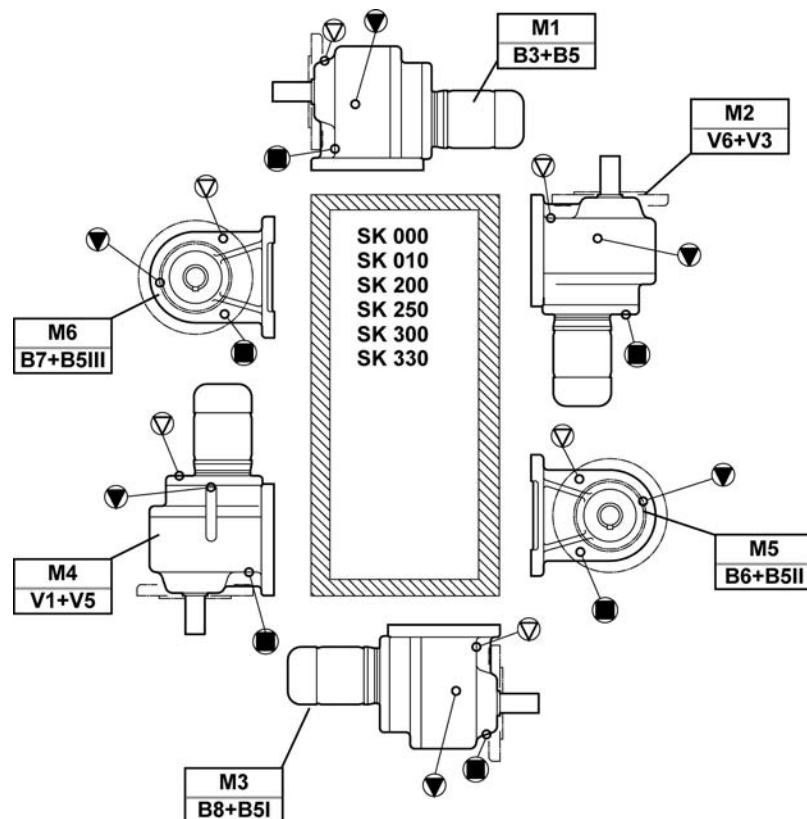
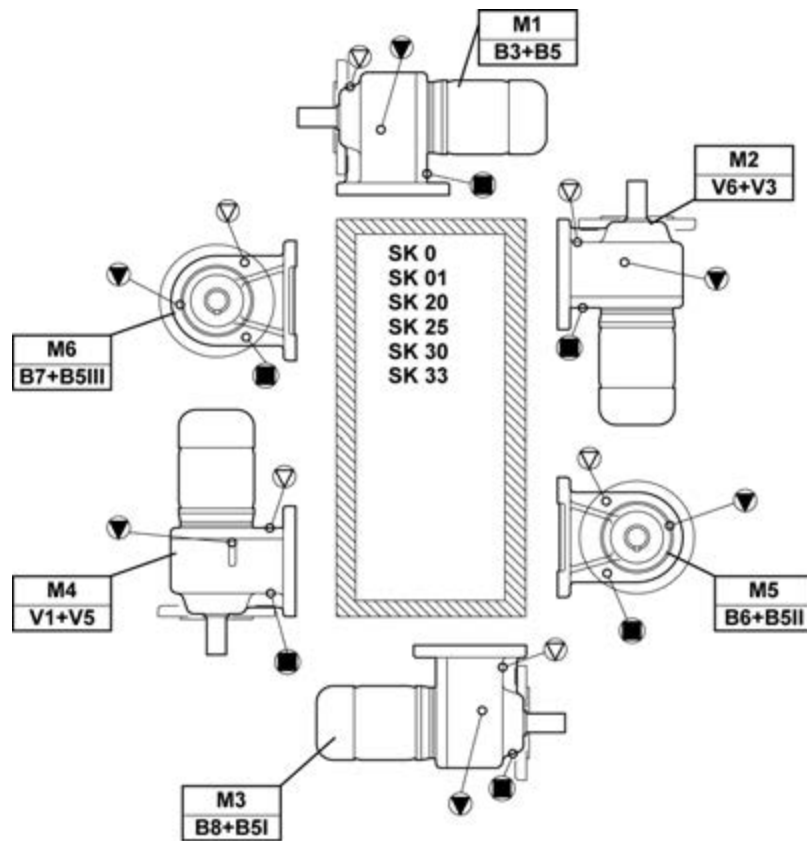


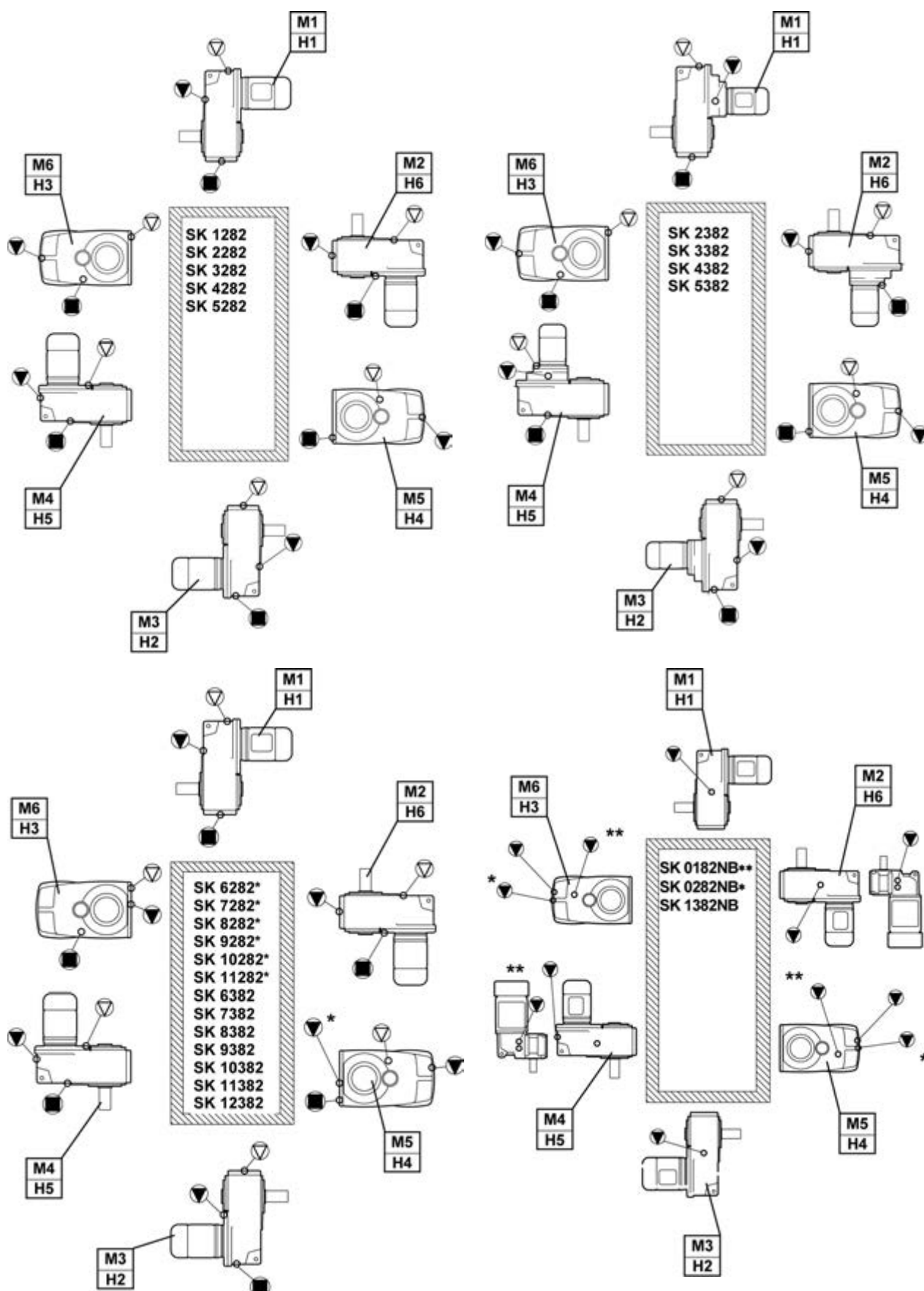
## 6 Appendix



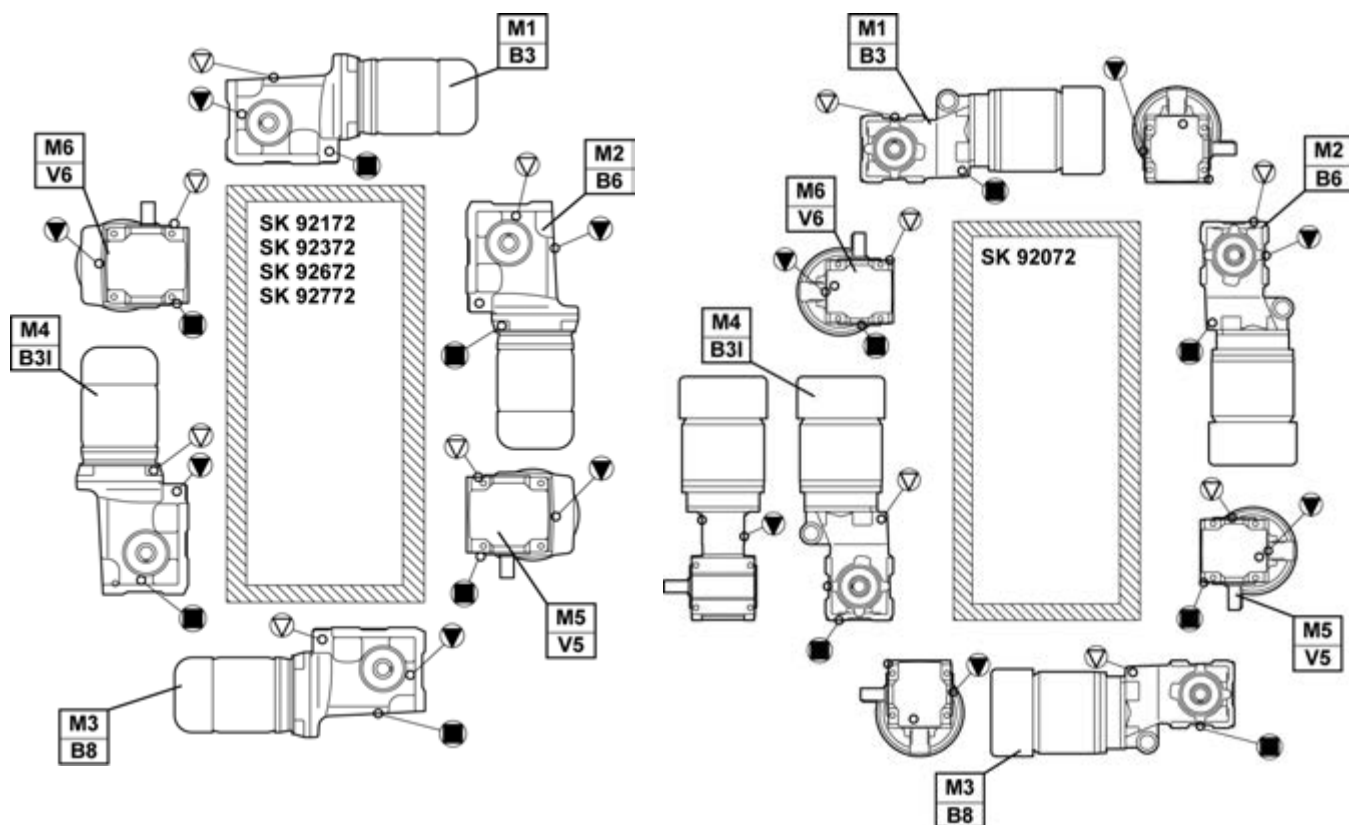
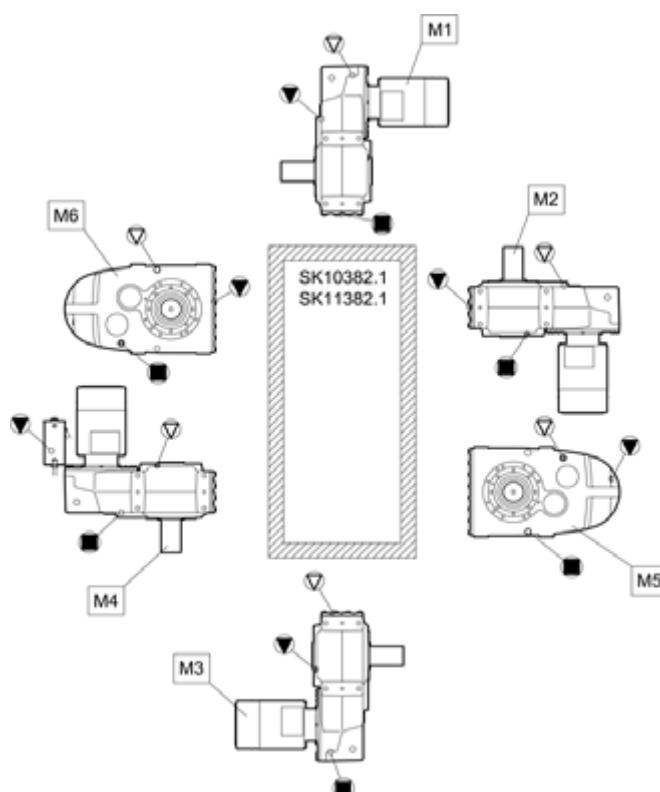


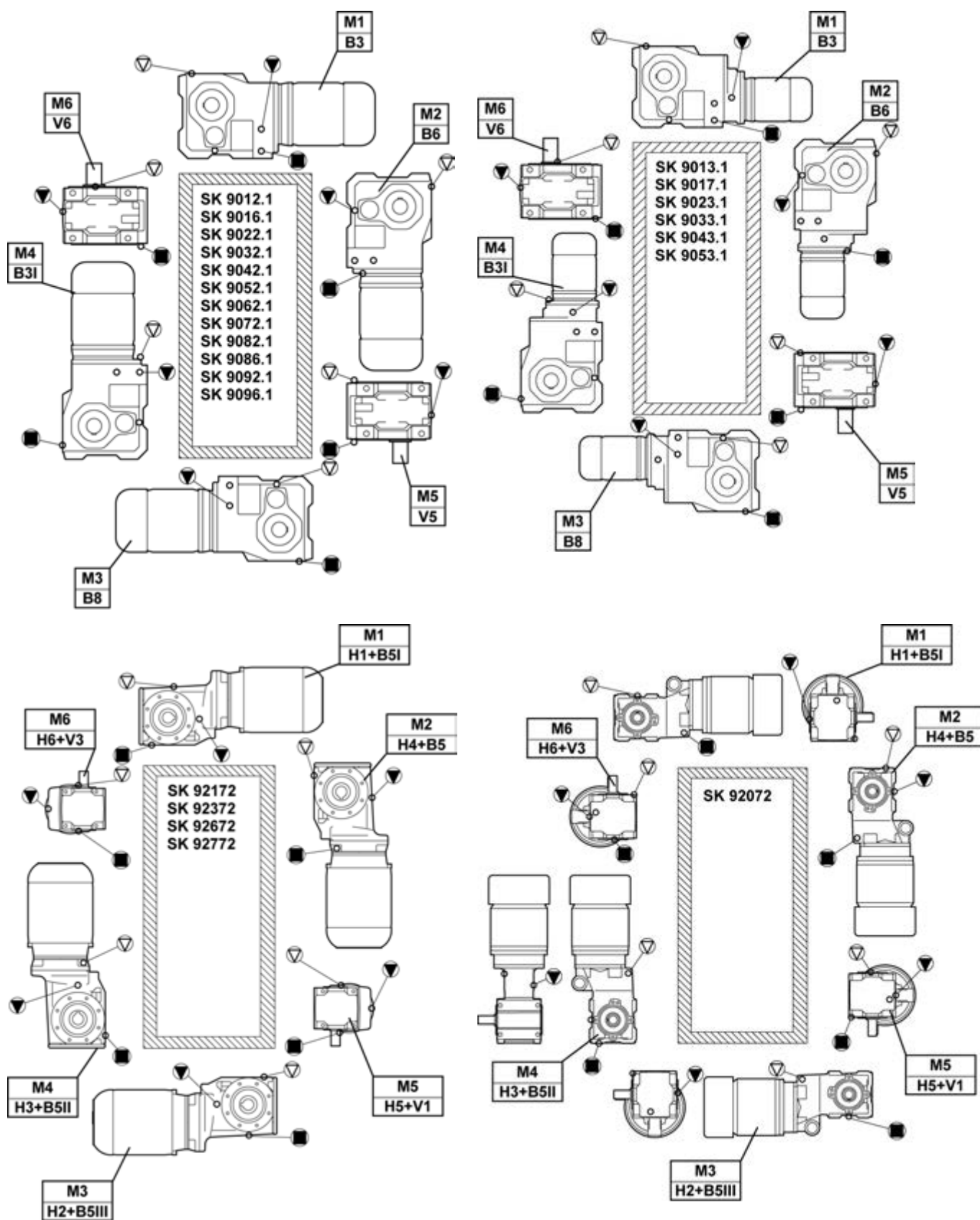






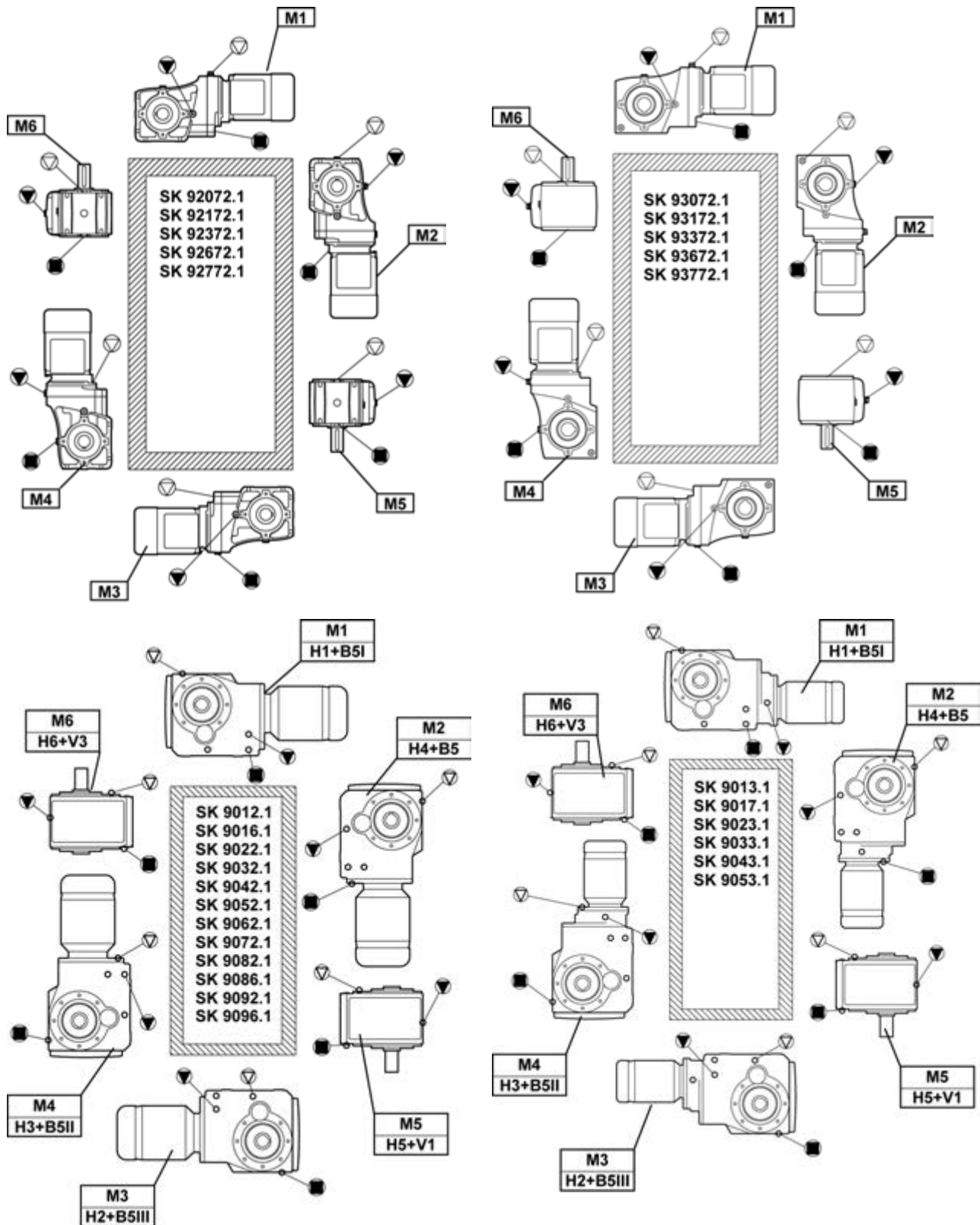
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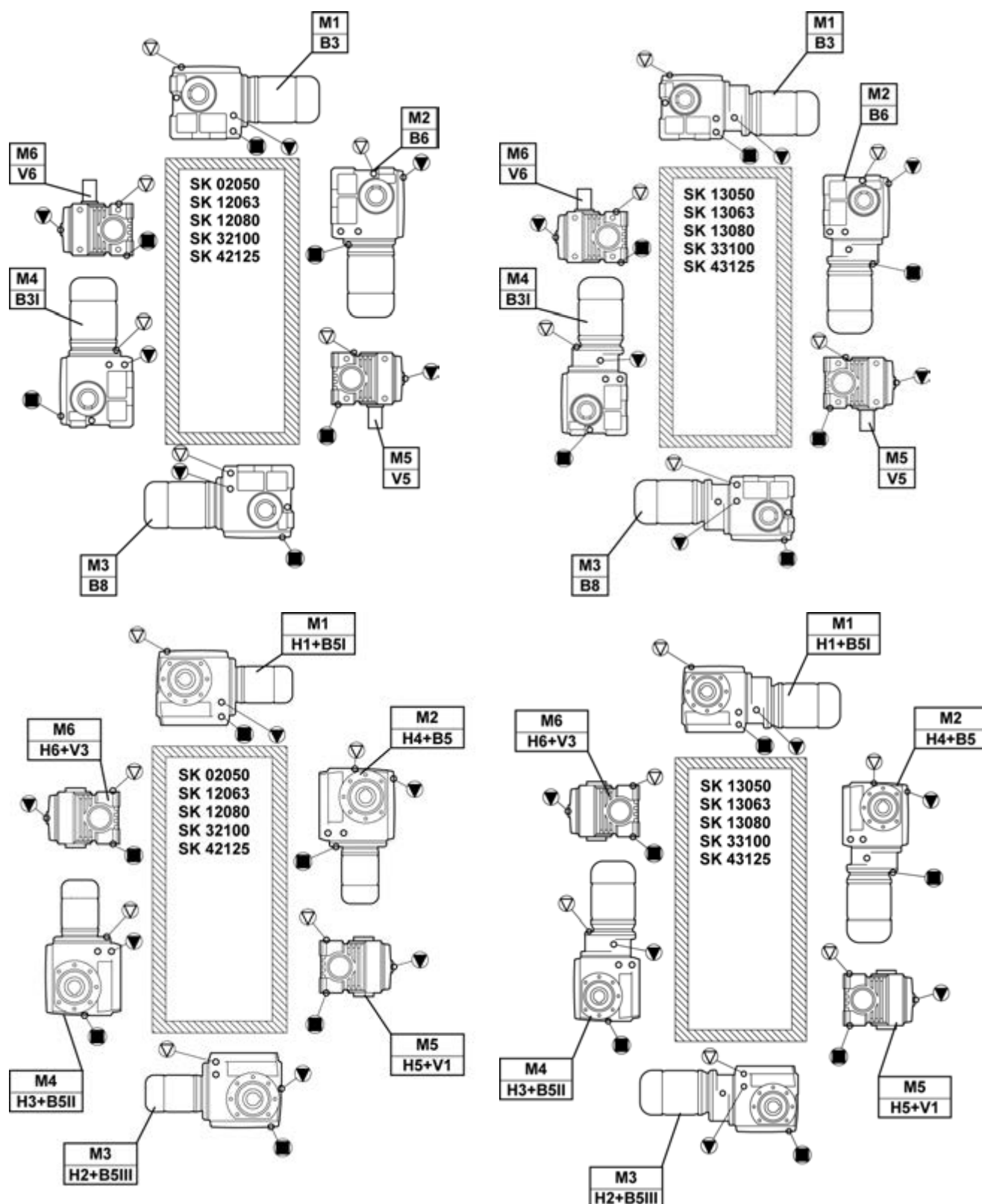


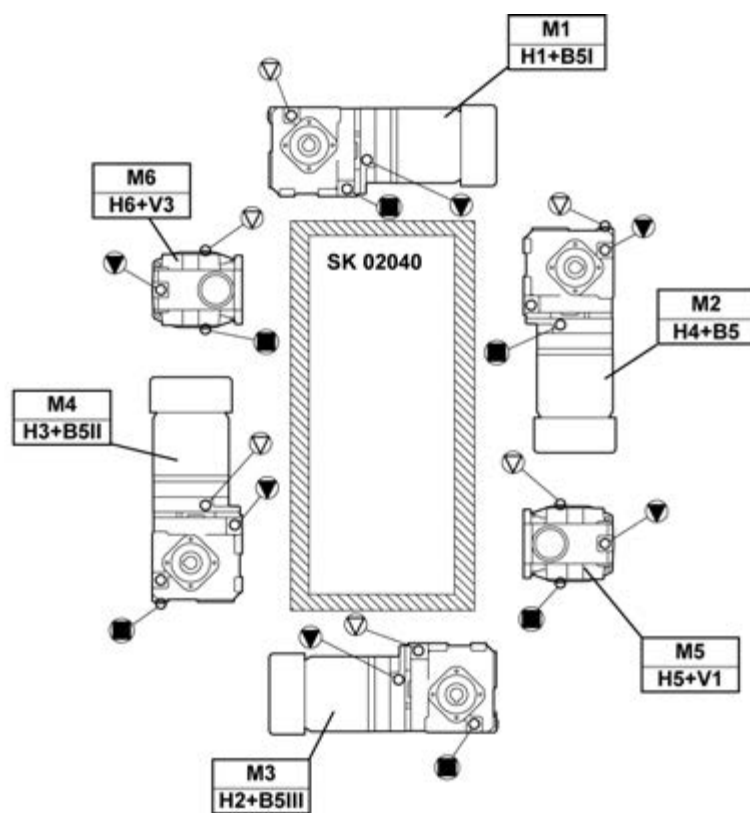
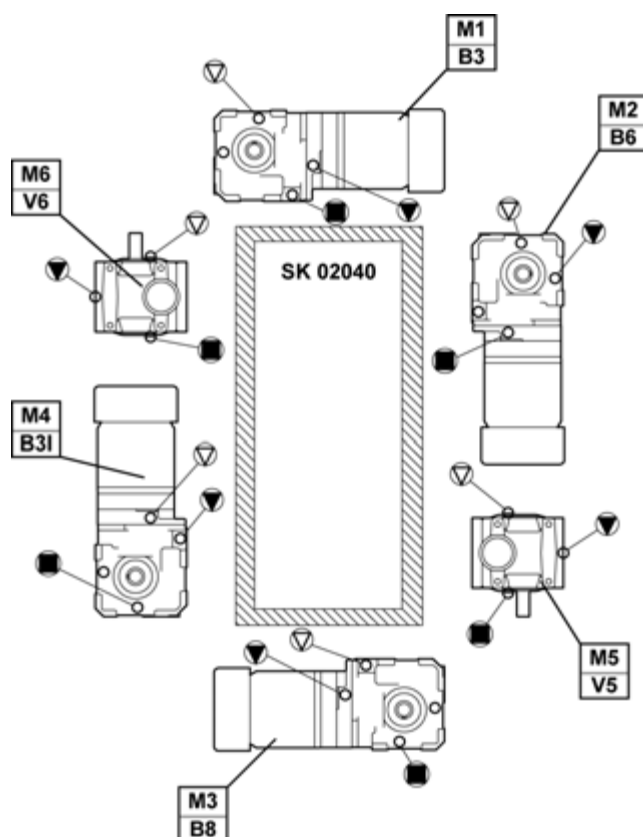




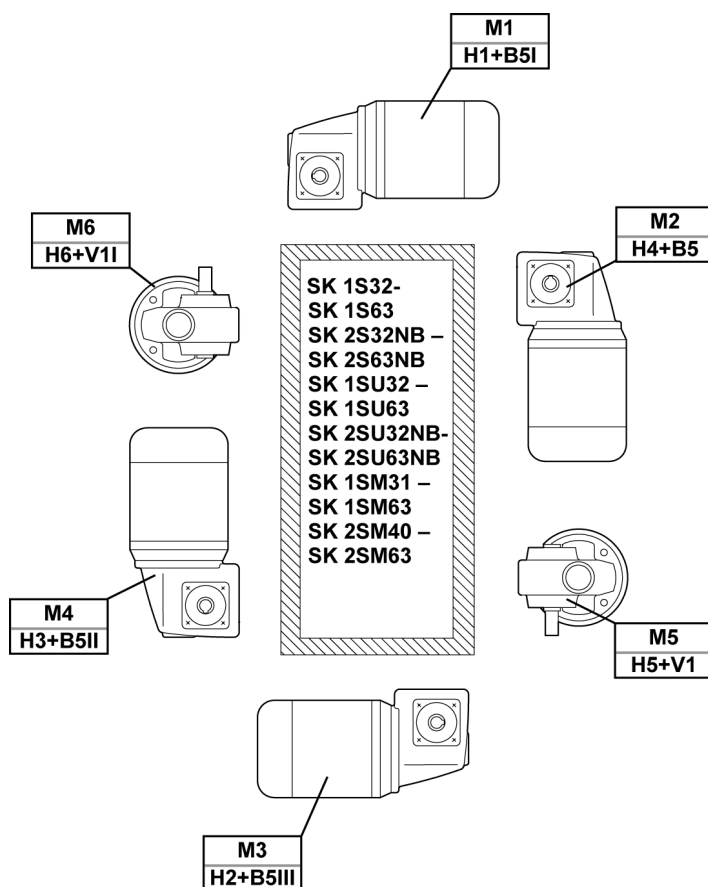
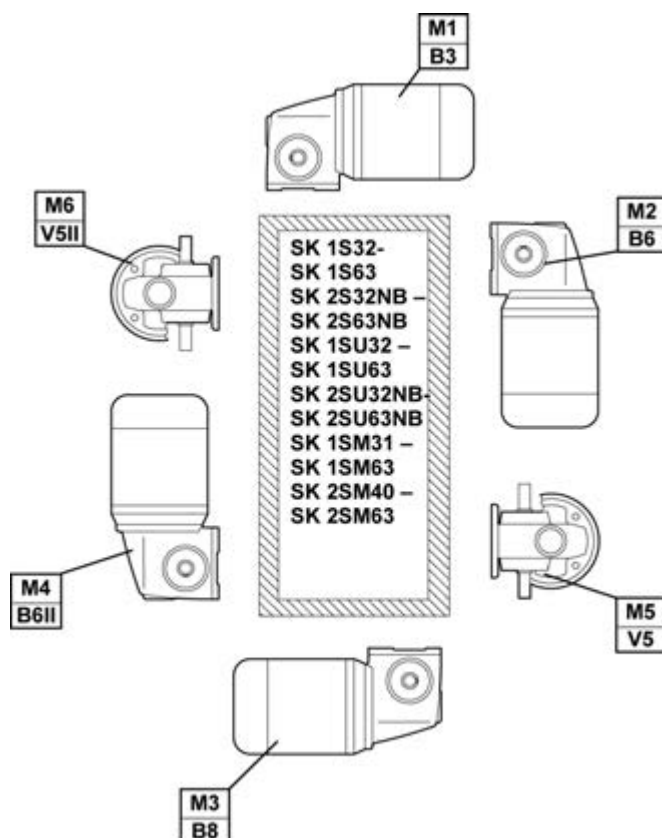
## 6 Appendix











## 6.2 Lubricants

### DANGER!

### Explosion hazard



Explosion hazard. Failure to comply may cause severe, or even fatal injuries.

When changing oil or filling for the first time, the type of lubricant stated on the type plate must be used.

The following table shows the approved proprietary brands or product names according to the gear oil types stated on the type plate (please see chapter 3.5 "Checking the type plate data"). This means that a product corresponding to the type of oil shown on the type plate must be used. In special cases, the designation of the specified product is stated on the type plate of the gear unit.

Lubricant type	Details on type plate					
Mineral oil	CLP 220	Alpha EP 220 Alpha SP 220 Optigear BM 220 Tribol 1100 / 220	Renolin CLP 220 Renolin CLP 220 Plus Renolin GEAR 220 VCI	Klüberoil GEM 1-220 N	Mobilgear 600 XP 220	Omala S2 G 220
	CLP 100	Alpha EP 100 Alpha SP 100 Optigear BM 100 Tribol 1100 / 100	Renolin CLP 100 Renolin CLP 100 Plus	Klüberoil GEM 1-100 N	Mobilgear 600 XP 100	Omala S2 G 100
Synthetic oil (Polyglycol)	CLP PG 680	Alphasyn GS 680 Tribol 800 / 680	Renolin PG 680	Klübersynth GH 6-680	Mobil Glygoyle 680	Omala S4 WE 680
	CLP PG 220	Alphasyn GS 220 Alphasyn PG 220 Tribol 800 / 220	Renolin PG 220	Klübersynth GH 6-220	Mobil Glygoyle 220	Omala S4 WE 220
Synthetic oil (hydrocarbons)	CLP HC 220	Alphasyn EP 220 Tribol 1510/220 Optigear Synthetic X 220	Renolin Unisyn CLP 220 Renolin Unisyn Gear VCI	Klübersynth GEM 4-220 N	Mobil SHC 630	Omala S4 GX 220
Bio-degradable oil	CLP E 680	-	Plantogear 680 S	-	-	-
	CLP E 220	Tribol BioTop 1418 / 220	Plantogear 220 S	Klübersynth GEM 2-220	-	Naturelle Gear Fluid EP 220
Foodstuff compatible oil as per FDA 178.3570	CLP PG H1 680	Tribol FoodProof 1800 / 680	-	Klübersynth UH1 6-680	Mobil Glygoyle 680	Cassida Fluid WG 680
	CLP PG H1 220	Tribol FoodProof 1800 / 220	-	Klübersynth UH1 6-220	Mobil Glygoyle 220	Cassida Fluid WG 220
	CLP PG H1 680	Optileb GT 680	Cassida Fluid GL 680	Klüberoil 4 UH1-680 N		
	CLP PG H1 220	Optileb GT 220	Cassida Fluid GL 220	Klüberoil 4 UH1-220 N	Mobile SHC Cibus 220	

Table 14: Lubricant table

### 6.3 Torque values

Dimensions	Bolt Torques [Nm]					
	Screw connections in the strength classes			Cover screws	Threaded pin on coupling	Screw connections on protective covers
	8.8	10.9	12.9			
M4	3.2	5	6	-	-	-
M5	6.4	9	11	-	2	-
M6	11	16	19	-	-	6.4
M8	27	39	46	11	10	11
M10	53	78	91	11	17	27
M12	92	135	155	27	40	53
M16	230	335	390	35	-	92
M20	460	660	770	-	-	230
M24	790	1150	1300	80	-	460
M30	1600	2250	2650	170	-	-
M36	2780	3910	4710	-	-	1600
M42	4470	6290	7540	-	-	-
M48	6140	8640	16610	-	-	-
M56	9840	13850	24130	-	-	-
G½	-	-	-	75	-	-
G¾	-	-	-	110	-	-
G1	-	-	-	190	-	-
G1¼	-	-	-	240	-	-
G1½				300		-

Table 15: Torque values

#### Assembling the hose fittings

Oil the thread of the union nut, the cutting ring and the screw neck. Tighten the union nut with the wrench until the point where the union nut can only be turned with considerably more force. Turn the union nut of the screw fitting approx. 30° to 60° further but not more than 90°. For this the screw neck must be held with a wrench. Remove excess oil from the screw fitting

## 6.4 Troubleshooting



### WARNING

#### Injury to persons

There is a slipping hazard in case of leaks.

Clean the soiled floor and machine components before starting troubleshooting.



### WARNING

#### Injury to persons

Risk of injury due to rapidly rotating and hot machine components.

Troubleshooting must only be performed when gear units are at a standstill and have cooled down. The drive must be isolated and secured to prevent accidental start-up.

### NOTICE

#### Gear unit damage

Damage to the gear unit is possible in case of faults.

Shut down the drive unit immediately in case of any faults in the gear unit.

Gear unit malfunctions		
Fault	Possible cause	Remedy
Unusual running noises, vibrations	Oil too low or bearing damage or gear wheel damage	Consult NORD Service
Oil escaping from the gear unit or motor	Defective seal	Consult NORD Service
Oil escaping from pressure vent	Incorrect oil level or incorrect, contaminated oil or unfavourable operating conditions	Oil change: Use oil expansion tank (Option OA)
Gear unit becomes too hot	Unfavourable installation conditions or gear unit damage	Consult NORD Service
Shock when switching on, vibrations	Defective motor coupling or loose gear unit mounting or defective rubber element	Replace the elastomer gear rim, tighten the motor and gear unit fastening bolts, replace the rubber element
Drive shaft does not rotate although motor is running	Fracture in gear unit or defective motor coupling or shrink disc slippage	Consult NORD Service

Table 16: Overview of malfunctions

## 6.5 Leaks and seals

Gear units are filled with oil or grease to lubricate the moving parts. Seals prevent the escape of lubricants. A complete seal is not technically possible, as a certain film of moisture, for example on the radial shaft sealing rings is normal and advantageous for a long-term seal. In the region of vents, moisture due to oil may be visible due to the escape of oil mist because of the function. In the case of grease-lubricated labyrinth seals, e.g. Taconite sealing systems, used grease emerges from the sealing gap due to the principle of operation. This apparent leak is not a fault.

According to the test conditions as per DIN 3761, the leak is determined by the medium which is to be sealed, which in test bench tests exceeds the function-related moisture in a defined test period and which results in dripping of the medium which is to be sealed. The measured quantity which is then collected is designated as leakage.

Definition of leakage according to DIN 3761 and its appropriate use					
Term	Explanation	Location of leak			
		Shaft sealing ring	in IEC adapter	Housing joint	Venting
Sealed	No moisture apparent	No reason for complaint	No reason for complaint	No reason for complaint	No reason for complaint
Damp	Moisture film locally restricted (not an area)	No reason for complaint	No reason for complaint	No reason for complaint	No reason for complaint
Wet	Moisture film beyond the extent of the component	No reason for complaint	No reason for complaint	Repair if necessary	No reason for complaint
Measurable leakage	Recognisable stream, dripping	Repair recommended	Repair recommended	Repair recommended	Repair recommended
Temporary leakage	Temporary malfunction of the sealing system or oil leak due to transport *)	No reason for complaint	No reason for complaint	Repair if necessary	No reason for complaint
Apparent leakage	Apparent leakage, e.g. due to soiling, sealing systems which can be re-lubricated	No reason for complaint	No reason for complaint	No reason for complaint	No reason for complaint

**Table 17: Definition of leaks according to DIN 3761**

\*) Previous experience has shown that moist or wet radial shaft sealing rings stop leaking later. Therefore, under no circumstances can replacement be recommended at this stage. The reason for momentary moisture may be e.g. small particles under the sealing lip.

## 6.6 Declaration of Conformity

### 6.6.1 Explosion protected gear units and geared motors, Category 3G and 3D





	
<b>GETRIEBEBAU NORD</b> Member of the NORD DRIVESYSTEMS Group	
Getriebebau NORD GmbH & Co. KG <small>Getriebebau-Nord-Str. 1, 22041 Bargteheide, Germany, Fon. +49(0)4532 289 - 0, Fax +49(0)4532 289 - 2253, info@nord.com</small>	
<b>EC Declaration of Conformity</b> According to Directive 94/9/ EEC Annex VII	
NORD GmbH & Co. KG hereby declares that the gear units from the product series <span style="float: right;">Page 1 of 1</span>	
<ul style="list-style-type: none"> <li>• Helical gear units Type SK ...</li> <li>• Parallel shaft gear unit Type SK ...82, SK ...82NB</li> </ul>	<ul style="list-style-type: none"> <li>• Worm gear units Type SK 02..., SK 1Sl...,SK 12..., SK 13..., SK 3..., SK 4....</li> <li>• Bevel gear units Type SK 9....</li> </ul>
with ATEX labelling  II 2D / 2G	
comply with the following Directives: ATEX Directive for Products <span style="float: right;">94/9/EC</span>	
Applied standards: <div style="text-align: right;">           EN 1127-1: 2011            EN 13463-1: 2009            EN 13463-5: 2011         </div>	
Getriebebau NORD has deposited the documents required according to 94/9/EC Annex VIII with the following institution: <div style="text-align: right;">           DEKRA EXAM GmbH            Dinnendahlstraße 9            44809 Bochum            ID number:0158         </div>	
Bargteheide, 23.05.2014	
 U. Küchenmeister Manager	 Dr. O. Sadi Technical Manager

Fig. 31: Declaration of Conformity for Category 2G / 2D

## 6.6.2 Explosion protected gear units and geared motors, Category 3G and 3D





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Getriebebau NORD GmbH & Co. KG <small>Getriebebau-Nord-Str. 1, 22941 Bargteheide, Germany, Fon. +49(0)4532 289 - 0, Fax +49(0)4532 289 - 2253, info@nord.com</small>		
<b>EC Declaration of Conformity</b> According to Directive 94/9/ EEC Annex VII		
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with ATEX labelling  II 3D / 3G		
comply with the following Directives:		
ATEX Directive for Products	94/9/EC	
Applied standards:		
	EN 1127-1: 2011 EN 13463-1: 2009	
Bargteheide, 23.05.2014  U. Küchenmeister Manager		 Dr. O.Sadi Technical Manager

Fig. 32: Declaration of Conformity for Category 3G / 3D

## 6.7 Repair information

For enquiries to our technical and mechanical service departments, please have the precise gear unit type (type plate) and if necessary the order number (type plate) to hand.

### 6.7.1 Repairs

The device must be sent to the following address if it needs repairing:

**Getriebebau NORD GmbH & Co. KG**


**Service Department**

Getriebebau-Nord-Straße 1

22941 Bargteheide

No guarantee can be given for any attachments, such as encoders or external fans, if a gear unit or geared motor is sent for repair.

Please remove all non-original parts from the gear unit or geared motor.

 Information	Reason for return
If possible, the reason for returning the component or device should be stated. If necessary, at least one contact should be stated in case of queries.	
This is important in order to keep repair times as short and efficient as possible.	

### 6.7.2 Internet information

In addition, the country-specific operating and installation instructions in the available languages can be found on our Internet site: [www.nord.com](http://www.nord.com)

## 6.8 Abbreviations

<b>2D</b>	Dust explosion protected gear units zone 21	<b>FA</b>	Axial force
<b>2G</b>	Explosion protected gear units with ignition protection class "c"	<b>IE1</b>	Motors with standard efficiency
<b>3D</b>	Dust explosion protected gear units zone 22	<b>IE2</b>	Motors with high efficiency
<b>ATEX</b>	<b>AT</b> mospheres <b>EX</b> plosibles	<b>IEC</b>	International Electrotechnical Commission
<b>B5</b>	Flange fastening with through holes	<b>NEMA</b>	National Electrical Manufacturers Association
<b>B14</b>	Flange fastening with threaded holes	<b>IP55</b>	International Protection
<b>CW</b>	Clockwise, right-hand direction of rotation	<b>ISO</b>	International Standardisation Organisation
<b>CCW</b>	Counter-clockwise, left-hand direction of rotation	<b>pH</b>	pH value
<b>°dH</b>	Water hardness in German hardness degrees: 1°dH = 0.1783 mmol/l	<b>PPE</b>	Personal Protective Equipment
<b>DIN</b>	German standards institute	<b>RL</b>	Directive
<b>EC</b>	European Community	<b>VCI</b>	Volatile Corrosion Inhibitor
<b>EN</b>	European standard	<b>WN</b>	Getriebebau NORD factory standard
<b>FR</b>	Radial transverse force		



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## **NORD DRIVESYSTEMS Group**

**Headquarters and technology centre**  
in Bargteheide, near Hamburg

**Innovative drive solutions**  
for more than 100 branches of industry

**Mechanical products**  
Parallel, helical, bevel and worm gear drives

**Electrical products**  
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### **Headquarters:**

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## **Tilt Switches and Control Units**

~~Model 21-38 Control Unit~~  
Model 21-39 Heavy Duty  
Standard Probe

REC 2294 (FM/CSA) Rev K  
Part # 005794

NOTE: PROBE WIRED DIRECTLY TO DRYER PLC WITH I/S BARRIERS TO MAINTAIN  
CLASS I AND II CLASSIFICATION  
MODEL 21-38 CONTROL UNIT NOT FURNISHED

Revision History

Revision Number	Date Released	ECO Number	Release Specifics
Revision J	October 2003		Update Manual Graphics Updated
Revision K	October 2005	0700	Update Manual

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Said warranty shall not apply if the equipment shall not have been operated and maintained in accordance with seller's written instructions applicable to such equipment, or if such equipment shall have been repaired or altered or modified without seller's approval; provided, however, that the foregoing limitation of warranty insofar as it relates to repairs, alterations, or modifications, shall not be applicable to routine preventive and corrective maintenance which normally occur in the operation of the equipment.

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The equipment described in this manual has been approved by Factory Mutual Research (FM), Serial Number J.I. 3007189, for use in hazardous areas, as defined by the National Code and Canadian Standards Association International CSA, Certificate 1437653, provided the following requirements are met.

1. For dust ignitionproof, Class II, Divisions 1 and 2, Groups E, F and G. Tilt Switch Probe Model 21-39 used with Tilt Switch Control Model 21-38 and installed per drawing D06640T-0001 or D06640T-002.
2. For intrinsically safe, Class I, Divisions 1 and 2, Groups A, B, C and D. Tilt Switch Probe Model 21-39 used with Tilt Switch Control Model 21-38 and installed per drawing D06640T or D06640T-0004.

3. Probe Input/Output:

Intrinsically safe, Class I, Division 1 and 2, Groups A, B, C & D.

4. Control:

Dust ignition proof, Class II, III, Division 1, Groups E, F & G, Class II, III, Division 2, Groups F & G, T2A@Ta=85, when used with tilt switch probe per drawing D06640T-0001, -0002, -0003 or -0004.

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# About this Manual

This manual provides installation, operation, troubleshooting, and repair information for the *Pro-Line Tilt Switches and Control Units* from *Thermo Electron*.

## Who Should Use this Guide?

The manual is a learning resource and reference for anyone concerned with the installation, operation, or maintenance of the *Tilt Switches and Control Units*.

## Organization of this Guide

This Guide is organized into 5 chapters

Chapter 1: *Introduction - Tilt Switch Probe*

Chapter 1: *Introduction - Tilt Switch Control*

Chapter 3: *Inspection and Installation*

Chapter 4: *Theory of Operation*

Chapter 5: *Setup and Adjustment*

Chapter 6: *Troubleshooting*

Chapter 7: *Maintenance, Spares and Repair*

## Documentation Conventions

The following conventions are used in this manual to help easily identify certain types of information.

- **Bold** is used the first time a new term is introduced.
- *Italic* is used to for emphasis and terms that have already been introduced.
- Blue is used for references to other sections of the guide and serve as links in documents.
- **SMALL CAPS** are used in the in the names of setup, calibration, menu displays, and variables.
- **BOLD CAPITALS** are used for the names of keys.
- **Note:** Provides information of special importance to the reader. ▲
- **Hint:** This symbol indicates a hint that may be of value but not necessary for operation. ▲



## Safety Messages

Instructions in this manual may require special precautions to ensure the safety of the personnel performing the operations.

There are two levels of safety messages: warnings and cautions. The distinction between the two is as follows:



**WARNING.** Failure to observe could result in death or serious injury. ▲



**CAUTION.** Failure to observe may cause minor injury or damage the equipment. ▲

## General Precautions

Do not install, operate, or perform any maintenance procedures until you have read the safety precautions presented.



**WARNING.** Failure to follow safe installation and servicing procedures could result in death or serious injury. ▲

- Make sure only personnel trained by a Thermo Electron representative perform installation and maintenance procedures in accordance with the instructions in this manual.
- Allow only qualified electricians trained by a Thermo Electron representative to open and work in the electronics cabinet, and terminal boxes.
- Covers over the electronics and moving parts must always remain in place during normal operation. Remove only for maintenance with the machine's power OFF. Replace all covers before resuming operation.
- During maintenance, a safety tag (not supplied by Thermo) is to be displayed over the ON/OFF switch area instructing others not to operate the unit (ANSI:B157.1)



**CAUTION.** High voltage that may be present on leads could cause electrical shock. ▲

- The main isolator switch must be OFF when checking input AC electrical connections, removing or inserting any electrical item, or attaching voltmeters to the system.
- Allow a minimum of 5 minutes between turning the mains isolator to the OFF position and opening the cover of the machine.
- Use extreme caution when testing in, or, or around the electronics cabinet, high voltages in excess of 115V or 230 V are present in these areas.



**WARNING:** High voltage that may be present on leads could cause electrical shock. ▲

- All switches must be OFF when checking input AC electrical connections, removing or inserting printed circuit boards, or attaching voltmeters to the system.
- Use extreme caution when testing in, on, or around the electronics cabinet, PC boards, or modules. There are voltages in excess of 115 V or 230 V in these areas.
- **WARNING.** Do not make changes to this equipment of any kind without prior consultation with Thermo. ▲





# Chapter 1

## Introduction Tilt Switch Probe

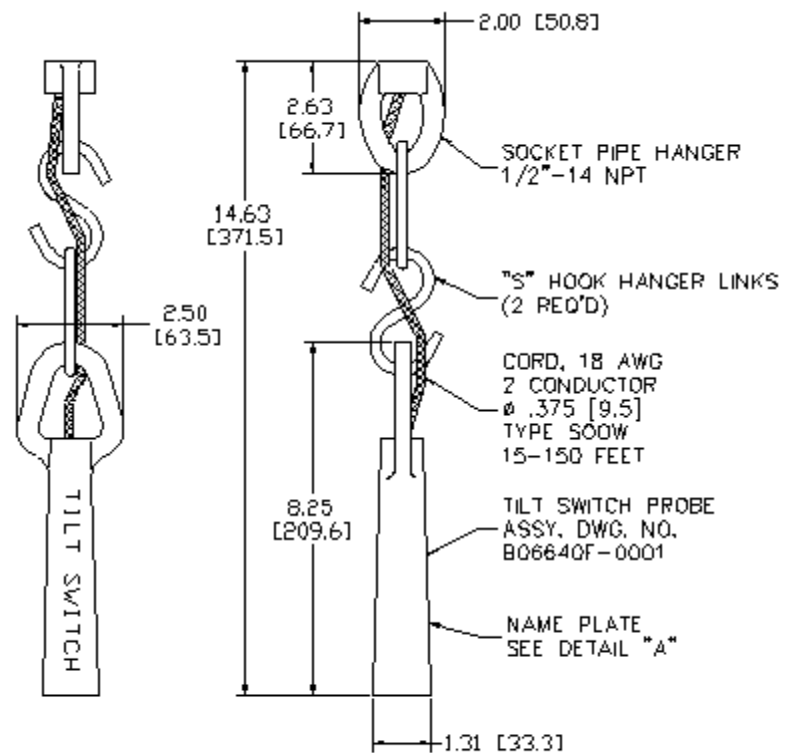
### Introduction

The Tilt Switch Probe actuates when it is tilted 15 degrees or more from its vertical position. The Mercury Switch is precisely positioned so that regardless of direction of tilt the normally closed contact will open.

### Specifications

(1)	Contact -	Normally closed Mercury Switch
(2)	Contact Rating -	1 Amp at 24 VDC Non-Inductive
(3)	Temperature Ratings	
	Model 21-39	-25° - 180° F
(4)	Housing	Ductile Iron
(5)	Finish	Chrome Plated Nickel
(6)	Dimensions	See <b>Figure 1-1</b>
(7)	Tilt Angle	10° to 25°

**Figure 1-1. Tilt Switch Probe**



\*DIMENSIONS ARE INCHES AND [mm]

## Chapter 2

# Tilt Switch Control

### Introduction

The Control Unit is housed in an enclosure with large green ("Normal") and red ("Alarm") indicating lights on the front cover. A 0-10 second adjustable time delay circuit in the control unit prevents momentary tilting of the switch from causing a false or premature contact transfer. Two normally open and two normally closed output contacts are available for connection to external alarms and/or controls. Interruption of line power causes a relay transfer.

### Specifications

- (1) Power Requirements
 

Voltage -	115 VAC $\pm$ 10%
Frequency	47 60 62 Hz
Consumption	10 Watts
- (2) Outputs
 

One (1) DPDT contact. Rated at 10 Amp at 115 VAC or 7 Amp at 30 VDC non-inductive
- (3) Time Delay
 

Adjustable:	0-10- 23 seconds
-------------	------------------
- (4) Selectable Jumper
 

Permits normal output condition for either vertical or tilted position of probe
- (5) Classification
 

Probe Input/Output:	Intrinsically safe, Class I, Division 1 and 2, Groups A, B, C, and D
Control:	Dust ignition proof, Class II, III, Division 1, Groups #, F & G, Class II, III, Division 2, Groups F & G, T2A@Ta=85, when used with tilt switch probe per drawing D06640T-0001, -0002, -0003, or -0004
- (6) Dimensions
 

See **Figure 2-1**
- (7) Temperature Rating
 

-40° to 140° F

Enclosure versions with conduit hubs NEMA 12, 4, and 4X

Figure 2-1. Switch Control (FM)

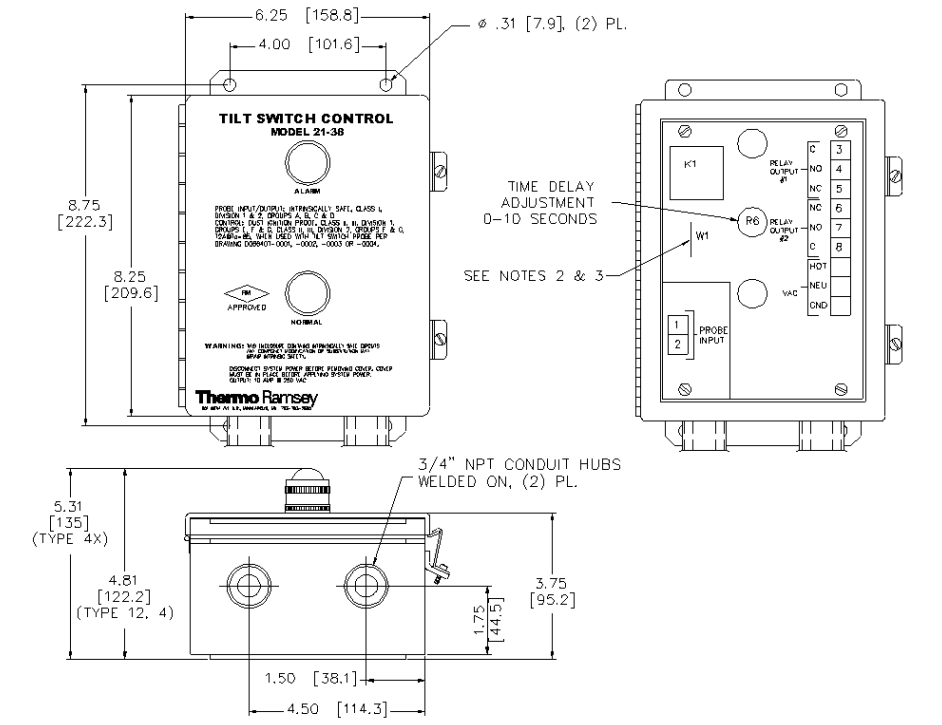
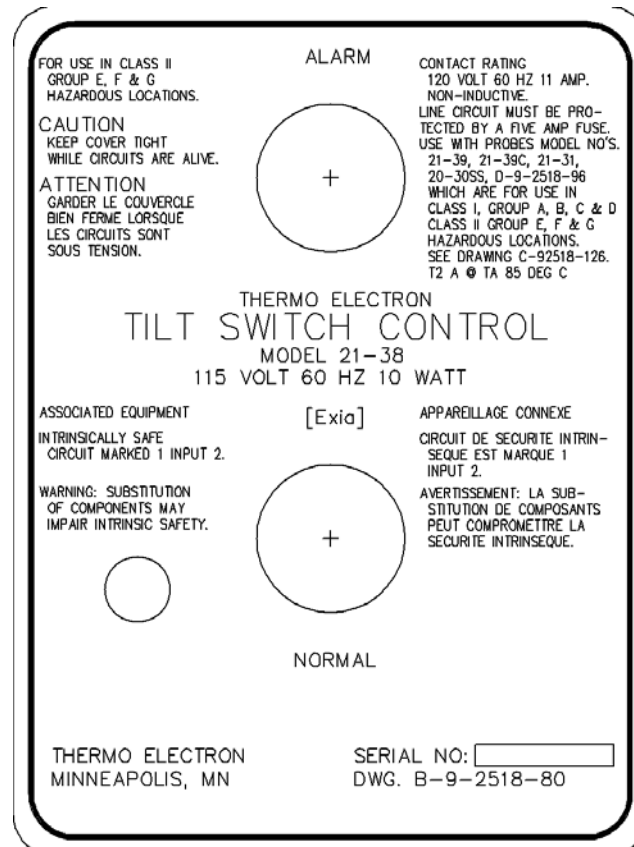


Figure 2-2. Switch Control CSA



## Chapter 3

# Inspection and Installation

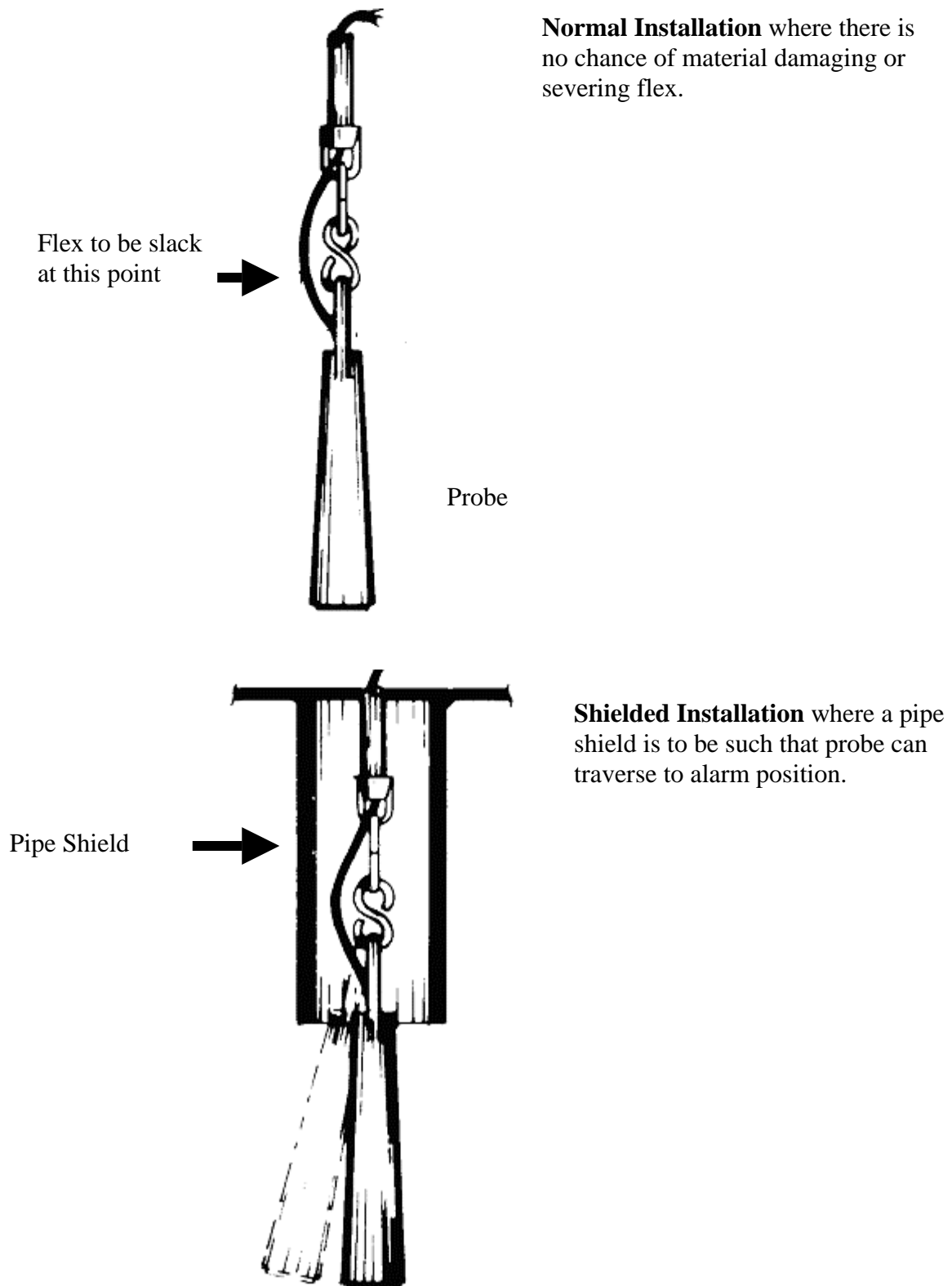
### Inspection

Inspect the packages for external damage before opening as often times the carrier can be held responsible for shipping damages. After unpacking, inspect the unit for broken components, etc.

### Installation - Tilt Switch Probe

1. Refer to **Figure 1–1** for Dimensional Data
2. Refer to for Installation Methods

**Figure 3-1. Tilt Switch Probe Installation Methods**

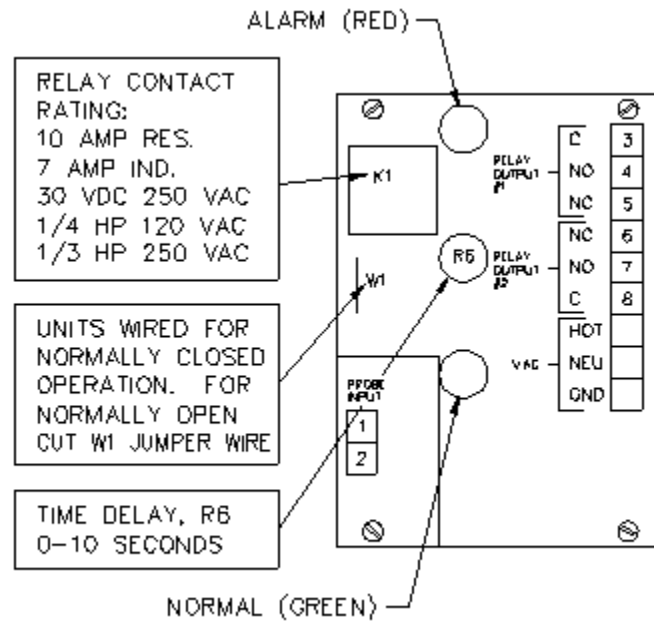
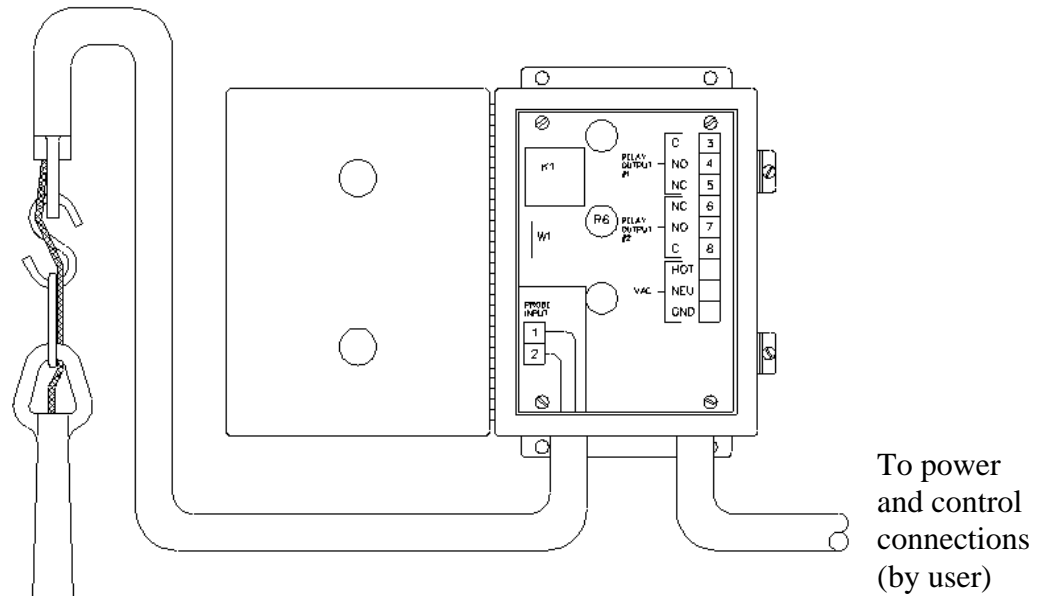


## **Installation - Tilt Switch Control**

1. Refer to **Figure 2-1** for Dimensional Data
2. The Control Unit should be mounted in a vibration free area where the ambient temperature does not exceed 120° F.

## **Installation - Electrical**

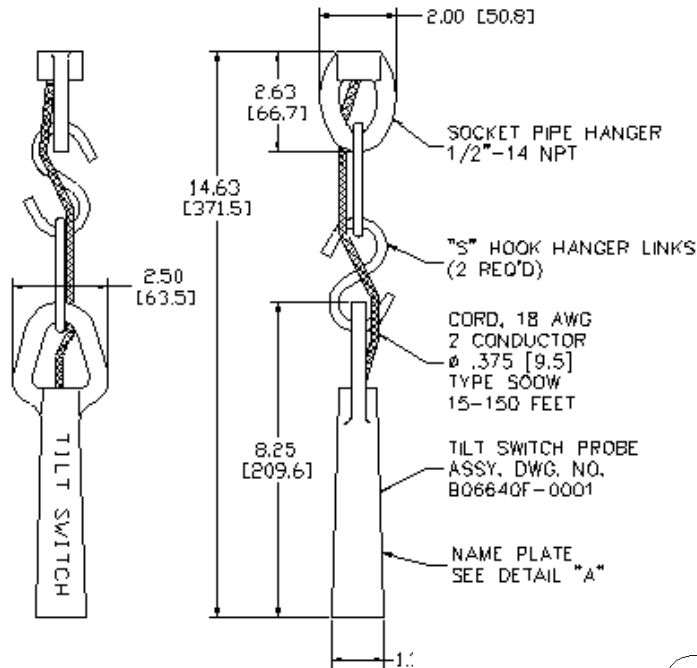
1. The Control Unit enclosure is supplied with two (2) 3/4"-14-NPT conduit hubs in the bottom.
2. User separate conduit for probe and power circuits.
3. Refer to Figure 3-4.

**Figure 3–2. Terminal Strip Data****Figure 3–3. Recommended Field Wiring****Notes:**

1. All wiring by user
2. Wiring to conform to applicable national electric code specifications for area where assembly is located.



Figure 3-4. Probe - Hazardous Area Class II; Control - Non-Hazardous Area



\*\*DIMENSIONS ARE INCHES AND [mm]

HAZARDOUS AREA, CLASS II, III  
DIVISION 1, GROUPS E, F & G  
CLASS II, III, DIVISION 2,  
GROUPS F & G

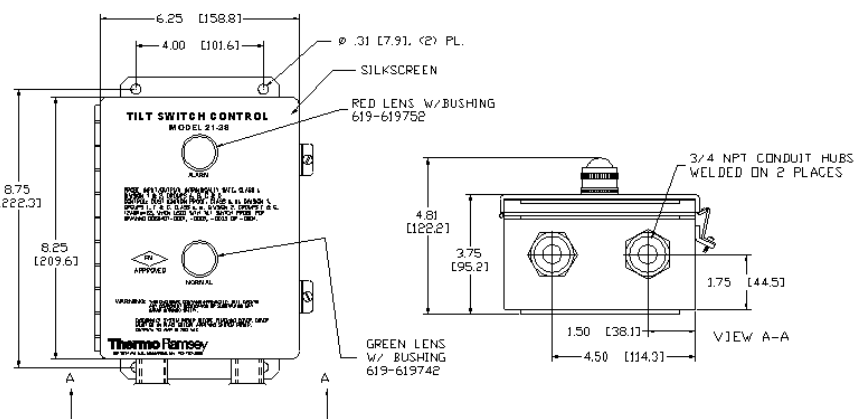
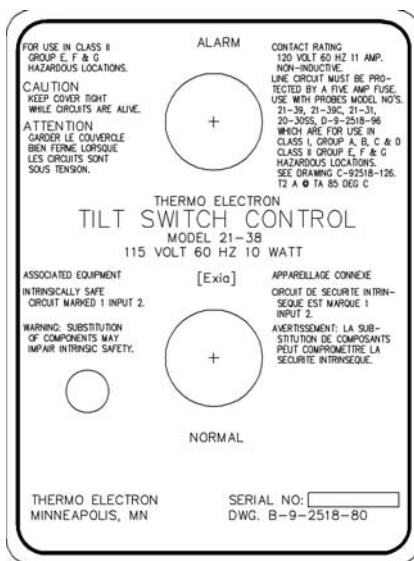
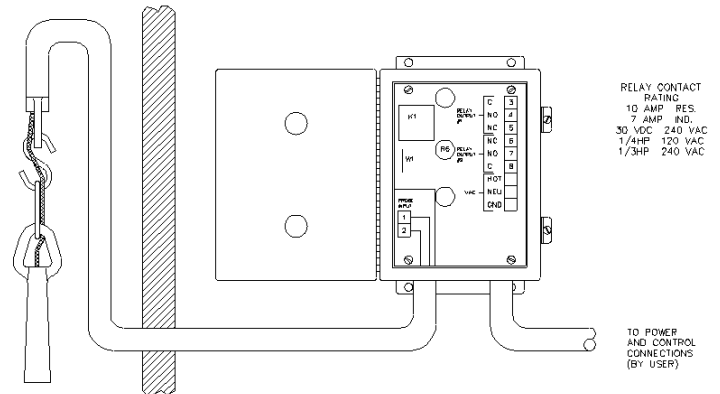
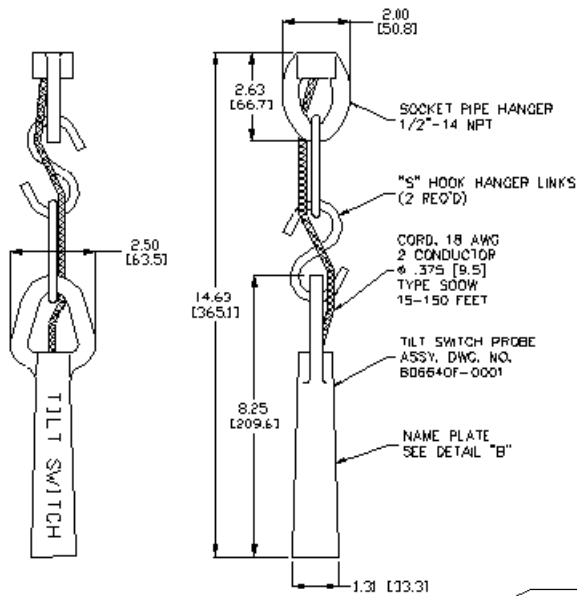
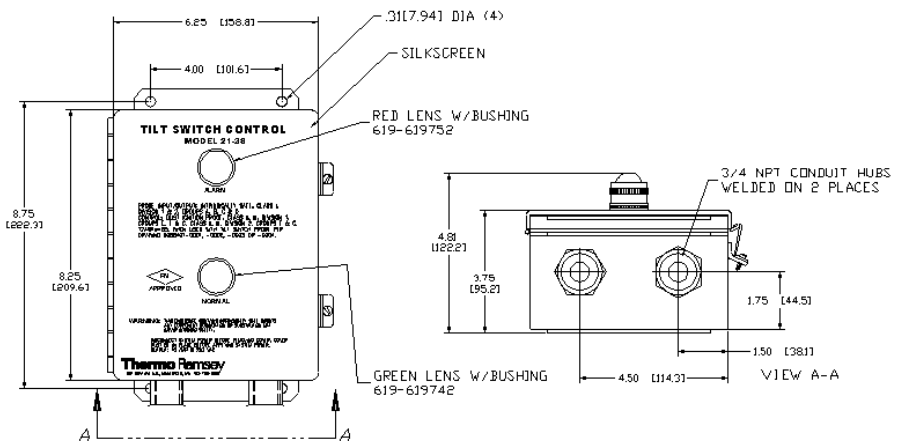
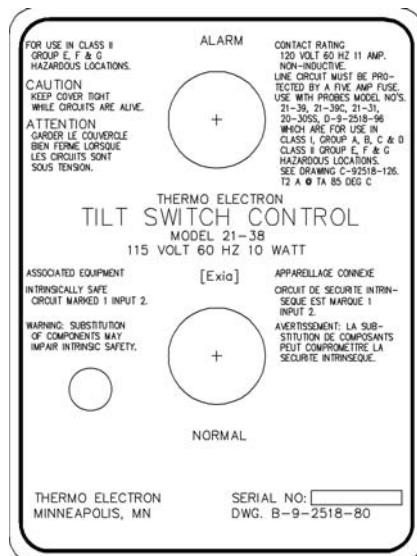
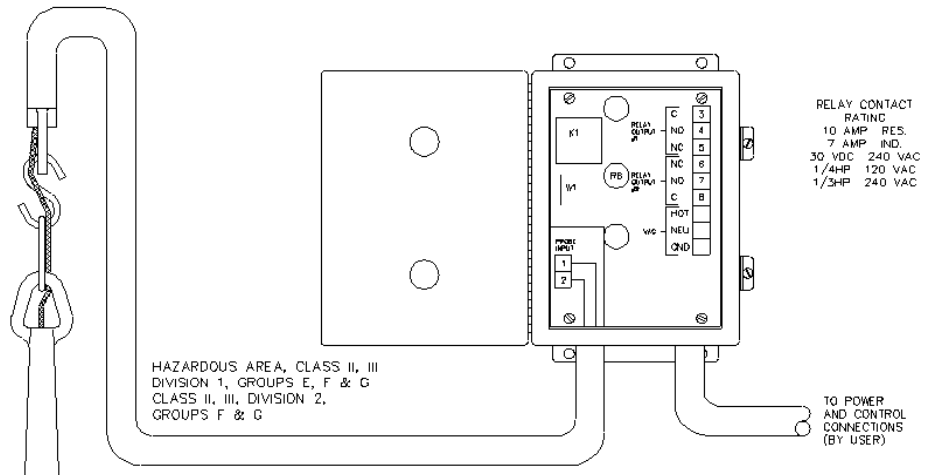


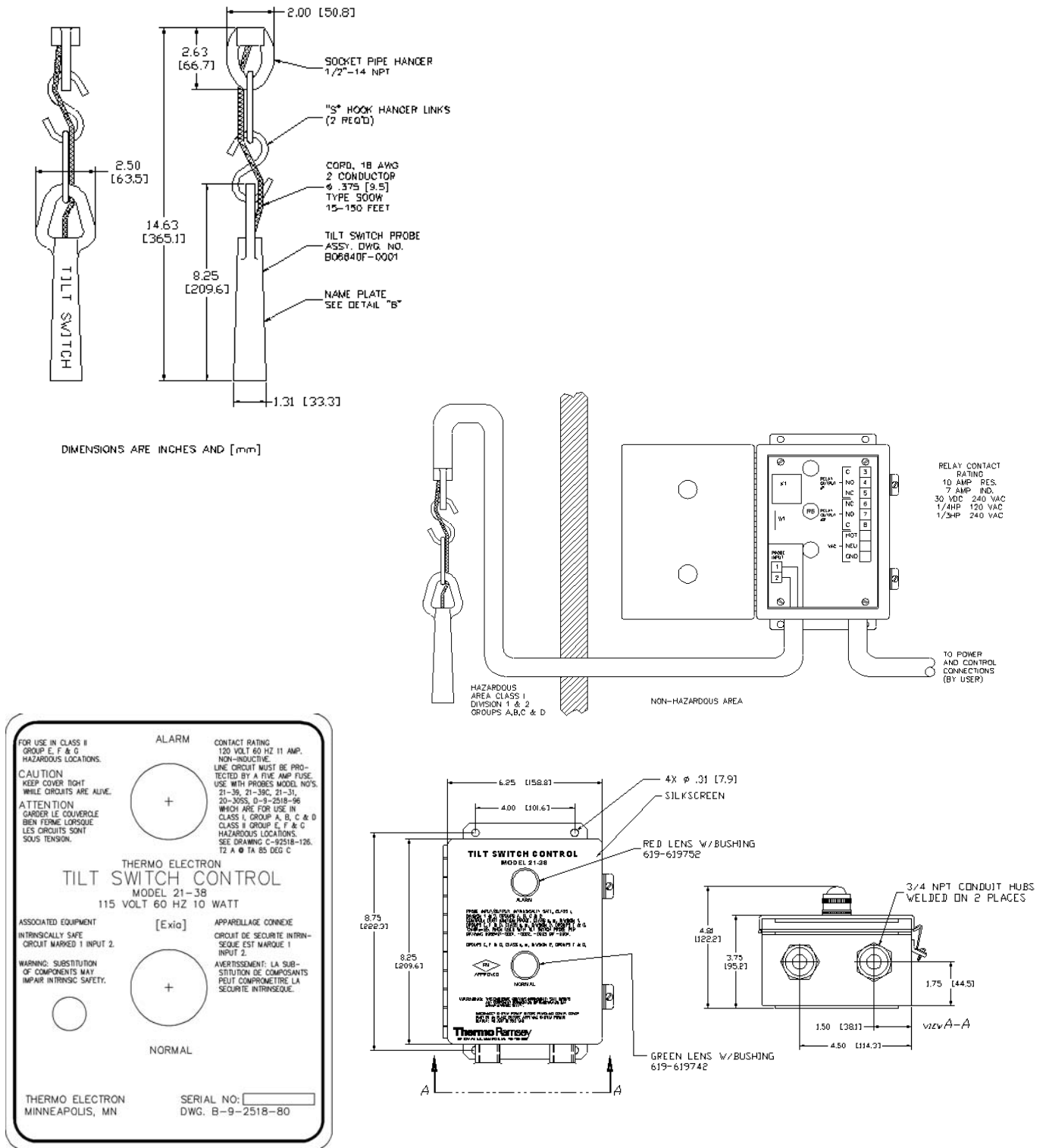
Figure 3-5. Probe &amp; Control - Hazardous Area Class II



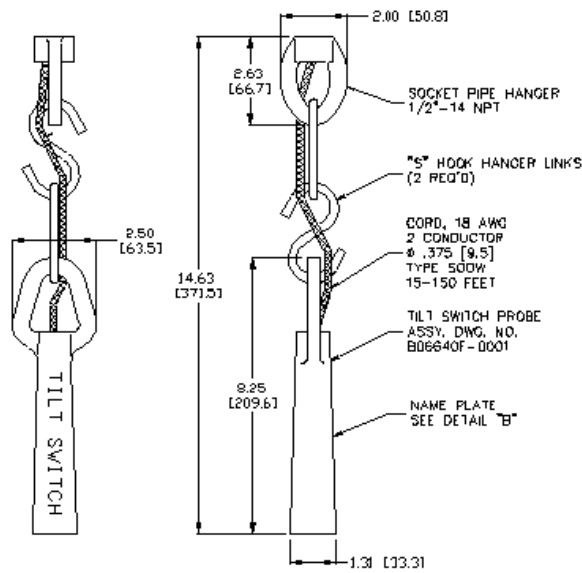
\*\*DIMENSIONS ARE INCHES AND [mm]



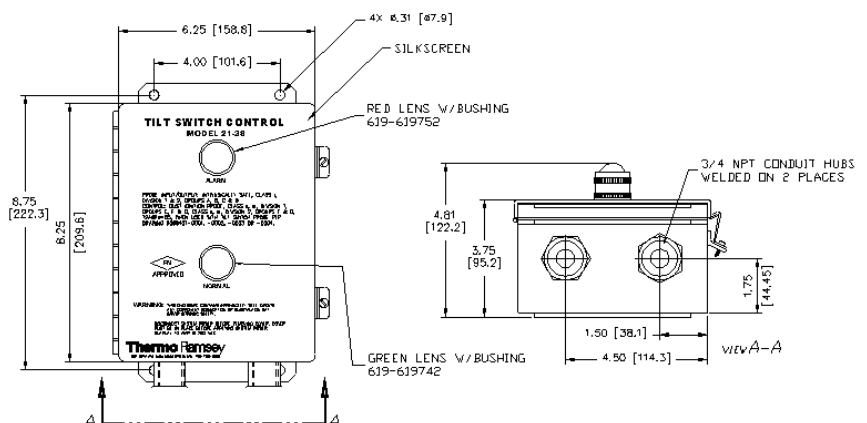
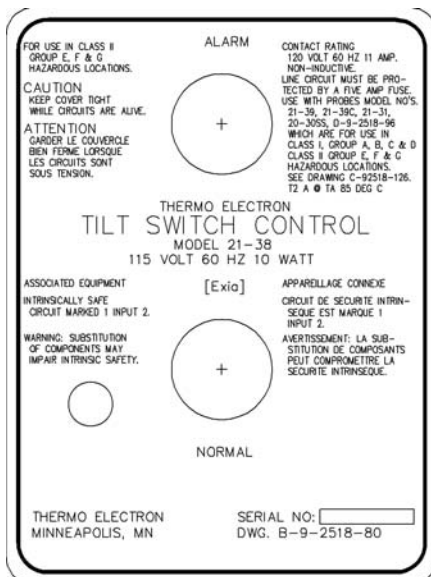
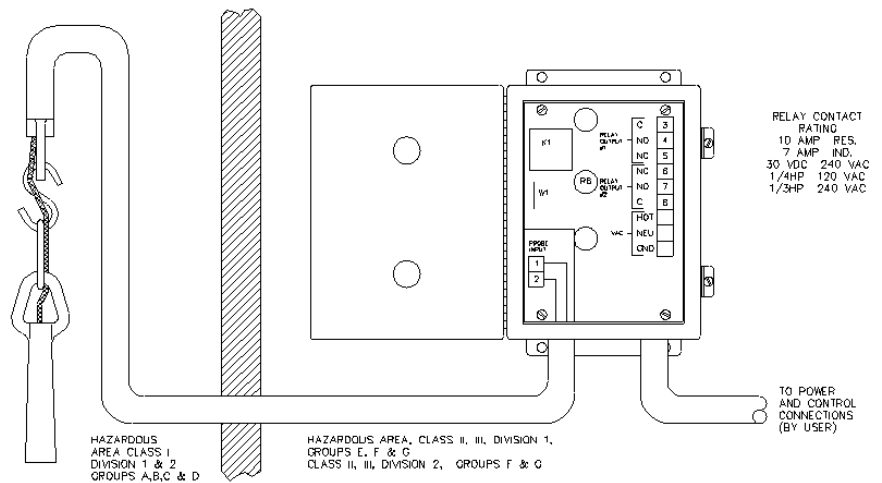
**Figure 3-6. Probe - Hazardous Area Class I; Control - Non-Hazardous Area**



**Figure 3-7. Probe - Hazardous Area Class I Control - Hazardous Area Class II**



\*\*DIMENSIONS ARE INCHES AND [mm]



## Chapter 4

# Theory of Operation

### General

Refer to **Figure 4–1** and **Figure 4–2** while reading the following circuit description.

### Circuit Description

The Tilt Switch Control consists of five Functional circuits. They are (1) DC power supply, (2) Switch Closure Detector, (3) Time Delay Generator, (4) Relay Drive Circuitry, and (5) Power Relay.

The switch closure detector is comprised of the D section of Schmidt Gate U1 and several high value resistors (R8 through R13). With the input (contacts 1 and 2) not shorted, pin 12 of U1D will be at ground potential which causes the output at pin 11 of this NAND gate to be positive. When the inputs, 1 and 2, are shorted together pin 12 of U1D is pulled to -15V causing an abrupt transition of pin 11, the output of U1D, from +15 to ground potential. This voltage change passes through jumper W1 and D5 to discharge C7 rapidly to ground potential causing output pin 3 of U1A to go positive.

The positive going signal at pin 3 of U1A turns on Q1, a low current triac which closes relay K1. In this condition the "normal" pilot light is lit. When input contacts 1 and 2 are not shorted, pin 12 of U1D goes to ground potential, causing pin 11, the output of U1D, to go positive. This positive going signal then must pass through the delay potentiometer, RN1, and charge up capacitor C6. Depending on this potentiometer's setting the time will be from 1 to 10 seconds before pins 1 and 2 of U1A go to positive enough to cause U1A to trigger and pin 3 to go to ground potential turning off triac Q1 and allowing relay K1 to open and the alarm light to come on.

The time delay portion of this circuit also contains section U1C, an inverting gate, which allows the operation of the input switch to be reversed. In normal operation (with W1 installed) the inverted signal from U1C is overridden since it must go through a 33K resistor before reaching diode D5. However, when W1 is removed the inverted signal is then operative and the operation of the circuit is the reverse of that described above.





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## Chapter 5

# Setup and Adjustment

**Setup** When the Tilt Switch System is used as a no flow detector the normal position of the probe is tilted and when used as a level detector the normal position is vertical (not tilted). Because these uses are opposite each other, one circuit board jumper must be checked before applying power.

Refer to **Figure 4-1** for location of jumper W-1.

Select from operational chart, Figure 5-1, the desired mode of operation and check jumper W-1 for conformance to chart, change jumper if necessary.

## Delay Adjustment

This adjustment will prevent relay output contacts from transferring when probe is momentarily or falsely tripped.

The range of adjustment is 0-10 seconds, because the actual delay time is application dependent it must be adjusted at the time of installation.

When setting this adjustment begin at the full CCW pot position and increase until false tripping is a minimum. A typical delay time is 5 seconds

**Table 5-1.** Operational Chart

Mode	Input	Terminal 1 & 2	Output Indication	Delay Initiated When Input Reverts To:	Relay State	Jumper W-1
	Tilt Switch Position					
No Flow Detector	Tilted	Open	Normal		Energized	Not Installed
	Vertical	Shorted	Alarm	X	De- Energized	
Level Detector	Tilted	Open	Alarm	X	De- Energized	Installed
	Vertical (no tilt)	Shorted	Normal		Energized	

**No Flow  
Detection**

- Normal Condition: Switch in “tilt” position
- Alarm Condition: Switch in vertical position

**Level Detection**

- Normal Condition: Switch in vertical position
- Alarm Condition: Switch in “tilt” position

## Chapter 6

# Troubleshooting

### General

The Tilt Switch control system has been designed to operate under normal industrial environments. The majority of failures encountered have been the result of excessive vibration, misapplication of the probe or switching excessive currents or voltages.

The operation of the control unit may be checked by following the procedure.



**CAUTION.** When following the procedure, remember that if the unit is controlling other equipment, the equipment concerned will either be shut down or started up, depending on the application.

### Troubleshooting Procedure

1. Check supply voltage. The proper voltage must be applied to terminals hot and neutral.
2. Disconnect probe wires at terminals 1 and 2.
3. Turn time delay control completely CCW. (Remember where it was set so that it may be returned to the same setting.)
4. Short across terminals 1 and 2. (There are no hazardous voltages at these terminals.) If the unit is operating properly, the following will occur:

The relay will reverse its state. (Careful observation thru the plastic cover of the relay will reveal movement of the armature if it is functioning.)

- The light that was illuminated will be de-energized and the one that was de-energized will be illuminated.
  - Relay operation may also be checked by disconnecting wires at terminals 3, 4, and 5 or 6, 7, and 8, and connecting an ohmmeter at the terminals.
5. Turn the time delay control slightly CW and repeat Step 4. The action as previously observed should be repeated, however, the relay de-energized action will be preceded by the delay period as set.

6. If the unit functions as described, the problem most likely is in the probe, its cable, or field wiring between the probe and the control unit. (This device may be checked with an ohmmeter for proper operation.) If the unit does not function as described, see the Maintenance chapter.

## Chapter 7

# Maintenance, Spares and Repair

### General

Except for the parts replacements mentioned below, Thermo Electron recommends that repairs not be attempted on this unit. Unauthorized repairs during the warranty period will void the warranty.

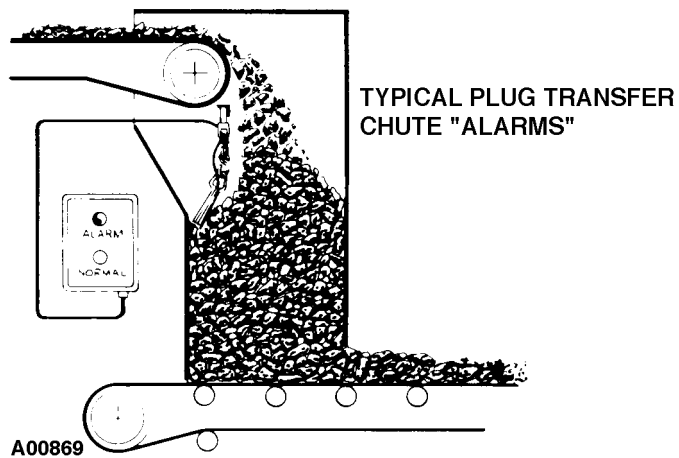
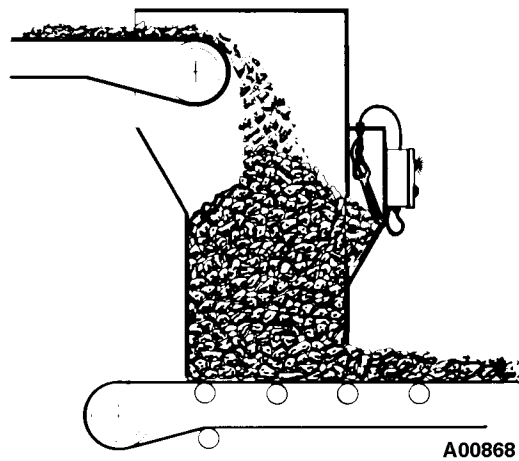
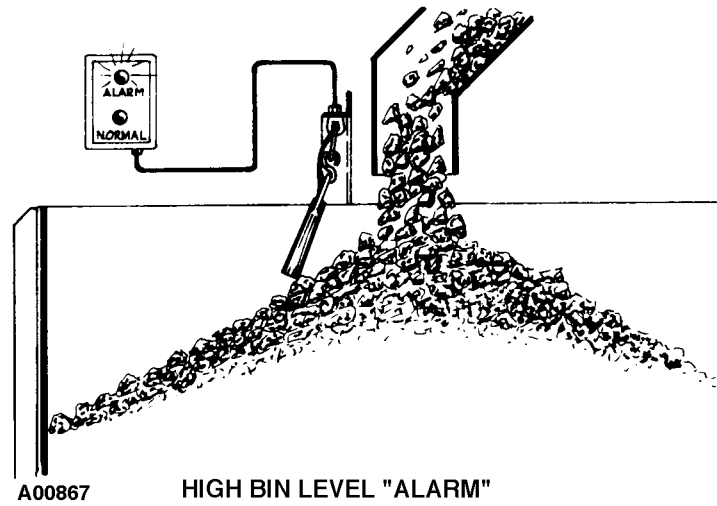
### Recommended Spares

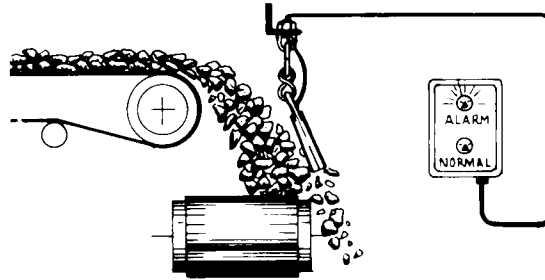
1. One (1) Thermo Electron 21-38-1 115 VAC, Part #069899 or 21-38-1 230 VAC, Part # 069867
2. Two (2) lamps 115 VAC, Part # 001470 or 230 VAC Part # 014197

### Repair

Upon notification, Thermo Electron will repair and return within two (2) weeks after receipt of equipment. Charges for repairing are based on time, material and handling.

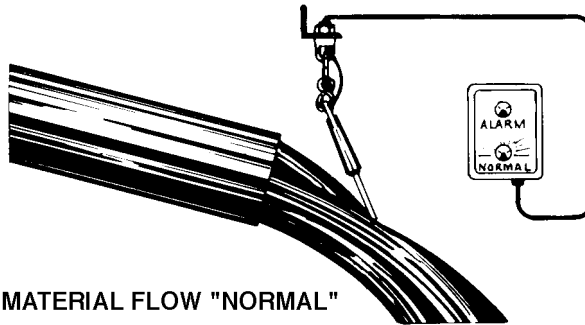
**Figure 7-1. General Applications**





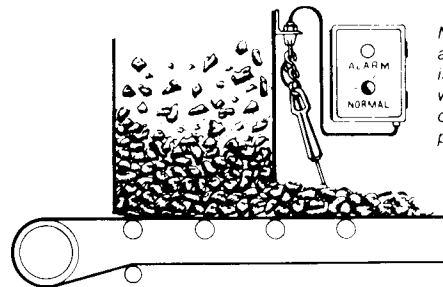
**MATERIAL OVERSHOOTING  
TRANSFER CONVEYOR "ALARM"**

**A00870**



**MATERIAL FLOW "NORMAL"**

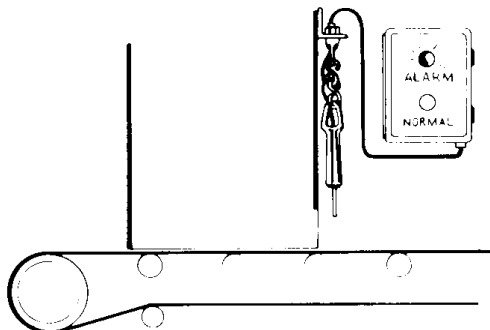
**A00871**



*NOTE: In this application probe is equipped with a wear plate for contact with product.*

**MATERIAL-FLOW "NORMAL"**

**A00872**



**MATERIAL NO FLOW "ALARM"**

**A00873**



**Komline-Sanderson**

12 Holland Av  
908-234-1000

Peapack, NJ 07977-0257  
Fax: 908-234-9487  
[www.komline.com](http://www.komline.com)

## OPERATION AND MAINTENANCE MANUAL

Title of Project: Lake County Public Works Department  
Des Plaines River WRF  
Phases 2B & 3 Improvements

Specification Number: 11650H Paragraph 2.5C

Specification Title: Detail Biosolids Thermal Drying System  
Dust Collection System  
Tag: T-12-19, M-12-19-1, M-12-19-2

Manufacturer: Komline-Sanderson

General Contractor: Williams Brothers Construction, Inc.

Subcontractor:

Supplier: Komline-Sanderson



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O&M MANUAL SUBMITTAL CHECKLIST (Page 1 of 5)

PROJECT NAME Des Plaines River WF

CONTRACT NO. Phase 2B and 3 Improvements

CONTRACTOR Williams Brothers Construction, Inc.

EQUIPMENT/SYSTEM Dust Collection System (Dust Collector, Exhaust Fan, Rotary Valve)

SECTION NO. 11650 H Paragraph 2.5C

MANUFACTURER/VENDOR UAS

FORMAT

Size: 8-1/2 x 11 or 11 x 17  
Paper: 20-pound minimum  
Text: Printed data/neatly typed  
Drawings: Standard size bound in text; in text-size labeled envelopes

Tabbed Section Dividers

Cover Label: Title  
Project Name  
Building/Structure ID  
Equipment Name  
Specification Section

Binders: Plastic Cover

O&M MANUAL SUBMITTAL CHECKLIST (Page 2 of 5)

GENERAL CONTENTS

<u>Provided</u>	<u>Not Applicable</u>	<u>Page No.</u>	
	X		One Specification Only
X		1	Title Page:
X		1	Title
X		1	Project title
	X		Building/structure ID
X		1	Equipment name
X		1	Specification section number
X		1	Contractor ID
	X		Subcontractor ID
X		8	Purchase order data
X		8	Manufacturer ID
X		8	Service/parts supplier ID
	X		Product List
X		2	Table of Contents
	X		Tabbed Sections:
	X		Pertinent data sheets
	X		Annotated as needed
			Text:
X		Various	Pertinent to project
X		Various	Annotated
			Drawings:
X		11-14, 23, 24, 26, 31, 32, 35, 41	Illustrate product and components
X		13, 14, 32, 62	Control and flow diagrams
			Special Information:
	X		Interrelationships of equipment and components
X		Various	Instructions and procedures
X		Various	Instructions organized in
X		Various	Instructions in logical
	X		Glossary
	X		Warranty, Bond, Service Contract

O&M MANUAL SUBMITTAL CHECKLIST (Page 3 of 5)

MANUAL FOR MATERIALS AND FINISHES

<u>Provided</u>	<u>Not Applicable</u>	<u>Page No.</u>	
_____	<u>  x  </u>	_____	Building Products:
_____	<u>  x  </u>	_____	Product data
_____	<u>  x  </u>	_____	Catalog number
_____	<u>  x  </u>	_____	Size
_____	<u>  x  </u>	_____	Composition
_____	<u>  x  </u>	_____	Color and texture designations
_____	<u>  x  </u>	_____	Care and Maintenance Instructions
_____	<u>  x  </u>	_____	Recommended cleaning agents and methods
_____	<u>  x  </u>	_____	Cleaning precautions
_____	<u>  x  </u>	_____	Cleaning and maintenance schedule
_____	<u>  x  </u>	_____	Moisture Protection Products:
_____	<u>  x  </u>	_____	Product data listing
_____	<u>  x  </u>	_____	Chemical composition
_____	<u>  x  </u>	_____	Installation details
_____	<u>  x  </u>	_____	Inspection recommendations
_____	<u>  x  </u>	_____	Maintenance and repair
_____	<u>  x  </u>	_____	Additional Data as Required

O&M MANUAL SUBMITTAL CHECKLIST (Page 4 of 5)

MANUAL FOR EQUIPMENT AND SYSTEMS

<u>Provided</u>	<u>Not Applicable</u>	<u>Page No.</u>	
<u>X</u>	<u>      </u>	<u>20-21</u>	Description of Unit and Components:
<u>X</u>	<u>      </u>	<u>Various</u>	Equipment functions
<u>X</u>	<u>      </u>	<u>11</u>	Normal operating characteristics
<u>      </u>	<u>X</u>	<u>      </u>	Limiting conditions
<u>X</u>	<u>      </u>	<u>85</u>	Performance curves
<u>X</u>	<u>      </u>	<u>11</u>	Engineering data
<u>      </u>	<u>X</u>	<u>      </u>	Test data
<u>X</u>	<u>      </u>	<u>44, 110, 111</u>	Replaceable parts list (with numbers)
<u>X</u>	<u>      </u>	<u>1</u>	P&ID numbers
<u>      </u>	<u>      </u>	<u>      </u>	Operating Procedures:
<u>X</u>	<u>      </u>	<u>40-43, 61, 62, 98, 99</u>	Startup
<u>      </u>	<u>X</u>	<u>      </u>	Break-in
<u>X</u>	<u>      </u>	<u>40-43, 61, 62, 98, 99</u>	Routine/normal operation
<u>X</u>	<u>      </u>	<u>65-66</u>	Regulation and control
<u>      </u>	<u>X</u>	<u>      </u>	Stopping and shutdown
<u>      </u>	<u>X</u>	<u>      </u>	Emergency
<u>      </u>	<u>X</u>	<u>      </u>	Seasonal operation
<u>      </u>	<u>X</u>	<u>      </u>	Special instructions
<u>      </u>	<u>      </u>	<u>      </u>	Maintenance Procedures:
<u>X</u>	<u>      </u>	<u>43-46</u>	Routine/normal instructions
<u>X</u>	<u>      </u>	<u>46-48, 77</u>	Troubleshooting guide
<u>X</u>	<u>      </u>	<u>43-46, 103-109</u>	Disassembly/reassembly/repair
<u>      </u>	<u>X</u>	<u>      </u>	Alignment/adjusting/balancing
<u>      </u>	<u>      </u>	<u>      </u>	Servicing and Lubrication:
<u>X</u>	<u>      </u>	<u>10</u>	List of lubricants
<u>X</u>	<u>      </u>	<u>9, 100, 101</u>	Lubrication schedule
<u>X</u>	<u>      </u>	<u>9</u>	Maintenance schedule
<u>X</u>	<u>      </u>	<u>*See below</u>	Safety Precautions/Features
<u>X</u>	<u>      </u>	<u>67-68</u>	Sequence of Operation of Controls
<u>X</u>	<u>      </u>	<u>11</u>	Assembly Drawings
<u>X</u>	<u>      </u>	<u>49, 50, 79, 110, 111</u>	Parts List and Illustrations:
<u>      </u>	<u>X</u>	<u>      </u>	Predicted life
<u>X</u>	<u>      </u>	<u>10</u>	Recommended spare parts list and prices
<u>X</u>	<u>      </u>	<u>13, 14, 32, 61, 62</u>	Control Diagrams/Schematics
<u>X</u>	<u>      </u>	<u>50</u>	Bill of Materials

\*19, 20, 13-25, 30, 34, 37, 40, 42-44, 45, 46, 59, 60, 61, 72, 89-93

O&M MANUAL SUBMITTAL CHECKLIST (Page 5 of 5)

<u>Provided</u>	<u>Not Applicable</u>	<u>Page No.</u>	
<u>  X  </u>	<u>      </u>	<u>8-10</u>	Completed Equipment Data Form
<u>      </u>	<u>  X  </u>	<u>      </u>	per Specification
<u>      </u>	<u>  X  </u>	<u>      </u>	Valves
<u>  X  </u>	<u>      </u>	<u>Various</u>	Catalog Cuts and Tag Numbers
<u>      </u>	<u>  X  </u>	<u>      </u>	Maintenance Instructions
<u>  X  </u>	<u>      </u>	<u>13, 14, 32, 62</u>	Panelboard Directories:
<u>  X  </u>	<u>      </u>	<u>13, 14, 32, 62</u>	Electrical
<u>      </u>	<u>  X  </u>	<u>      </u>	Controls
<u>      </u>	<u>  X  </u>	<u>      </u>	Communications
<u>      </u>	<u>  X  </u>	<u>      </u>	Instrumentation Loops:
<u>      </u>	<u>  X  </u>	<u>      </u>	Diagrams
<u>      </u>	<u>  X  </u>	<u>      </u>	Components list each circuit/loop
<u>      </u>	<u>  X  </u>	<u>      </u>	Additional Data As Required

EQUIPMENT DATA FORM (Page 1 of 3)

PROJECT NAME Des Plaines River WRF

CONTRACT NO. Phase 2B and 3 Improvements

CONTRACTOR Williams Brothers Construction, Inc.

EQUIPMENT NO. T-12-19, M-12-19-1, M-12-19-2

DESCRIPTION Dust Collection System (Dust Collector, Exhaust Fan, Rotary Valve)

LOCATION \_\_\_\_\_

MANUFACTURER United Air Specialists, Inc.

PURCHASED FROM United Air Specialists, Inc. PURCHASE DATE 2/6/17

VENDOR ORDER NO. \_\_\_\_\_ PURCHASE PRICE \$32,210

LOCAL SUPPLIER \_\_\_\_\_ PHONE 800-252-4647

ADDRESS 4440 Creek Rd., Cincinnati, OH 45242

MODEL NO. SFC 2-2 SHIPPING WT/UNIT 1,100 lbs est.

NO. OF UNITS One SERIAL NOS. \_\_\_\_\_

NAMEPLATE DATA

<u>ELECTRIC MOTOR</u>	<u>PUMP/HVAC UNIT</u>	<u>DRIVE/REDUCER</u>	<u>OTHER (I&amp;C)</u>
MANUFACTURER: Exhaust Fan: WEG Rotary Valve: Motovario	MANUFACTURER: Exhaust Fan <u>Cincinnati</u>	MANUFACTURER: _____	MANUFACTURER: _____
TYPE: <input checked="" type="checkbox"/> AC <input type="checkbox"/> DC	TYPE <u>Centrifugal</u>	TYPE: <input type="checkbox"/> GEAR	TYPE _____
HP Fan: 3 HP	SIZE _____	<input type="checkbox"/> V-BELT	SIZE _____
Valve: 0.75 HP		<input type="checkbox"/> CHAIN	
Fan: 3510		<input type="checkbox"/> VARIDRIVE	
RPM Valve: 1740	CAPACITY <u>1000 cfm</u>		CAPACITY _____
Fan: 460		SERVICE	
VOLTAGE Valve: 460	PRESSURE <u>-8" wc</u>	FACTOR _____	RANGE _____
Fan: 3.76 a			
AMPERAGE Valve: 1.35 a	ROTATION _____	RATIO _____	
Fan: 3			
PHASE Valve: 3	IMPELLER:		
	SIZE _____		
Fan: 182T			
FRAME Valve: IEC 80	MATERIAL _____		

EQUIPMENT DATA FORM (Page 2 of 3)

MAINTENANCE SUMMARY

EQUIPMENT NO. T-12-19, M-12-19-1, M-12-19-2

DESCRIPTION Dust Collection System (Dust Collector, Exhaust Fan, Rotary Valve)

MAINTENANCE OPERATION

List briefly each maintenance operation required and refer to specific information in Manufacturer's Maintenance Manual, if applicable. Refer by symbol to "Lubricant List" for Lubrication Operation.

FREQUENCY

List required frequency of each maintenance operation.

DUST COLLECTOR

Replace cartridge filters

As required when SP consistently exceeds 5" wc

Check compressed air system to insure clean, dry, oil free air

Periodically as recommended by Manufacturer

Check and clean air manifold of contaminants and condensation

Periodically

Check dust collector compressed air components (diaphragm and solenoid valves, tubing) for air leakage. Replace components defective or worn.

Periodically

Replace explosion vent. Check swing door for damage or deformation

After event

Empty dust collection drum

When full

EXHAUST FAN

Remove dust and dirt from motor

As required

ROTARY VALVE

Lubricate gear reducer

As required by reducer manufacturer

Replace packing

As required

Lubricate chain

Every 50 hours of operation



LUBRICANT/RECOMMENDED SPARE PARTS LIST

EQUIPMENT NO. T-12-19, M-12-19-1, M-12-19-2

DESCRIPTION Dust Collection System (Dust Collector, Exhaust Fan, Rotary Valve)

**LUBRICANT LIST**

<u>LUBRICANT REFERENCE SYMBOL</u>	<u>LUBRICANT TYPE (MILITARY STANDARD)</u>	<u>RECOMMENDED AND MANUFACTURER</u>
List symbol in "maintenance operation"	List general lubricant type	List specific lubricant name, viscosity and manufacturer
<u>Lubricate rotary valve chain</u>	<u>SAE30</u>	<u></u>
<u></u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>

**RECOMMENDED SPARE PARTS LIST**

<u>PART NO.</u>	<u>DESCRIPTION</u>	<u>UNIT</u>	<u>QUANTITY</u>	<u>UNIT COST</u>
<u>33-10089</u>	<u>ProTura® Nanofiber Cartridge Filter</u>	<u></u>	<u>2</u>	<u></u>
<u></u>	<u></u>	<u></u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>	<u></u>	<u></u>
<u></u>	<u></u>	<u></u>	<u></u>	<u></u>

NOTE: Identify parts provided by this Contract with two asterisks.

ADDITIONAL DATA AND REMARKS

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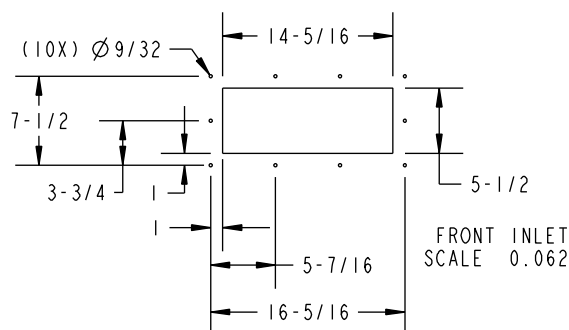
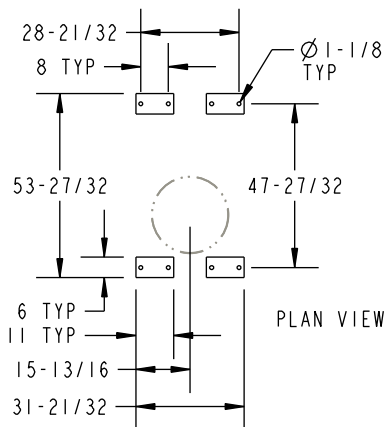
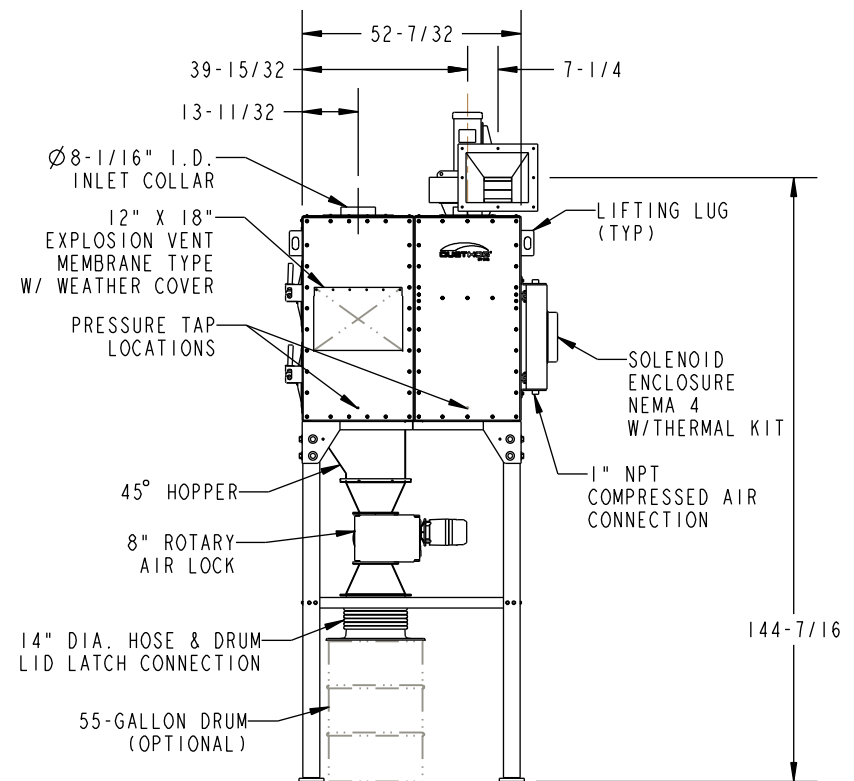
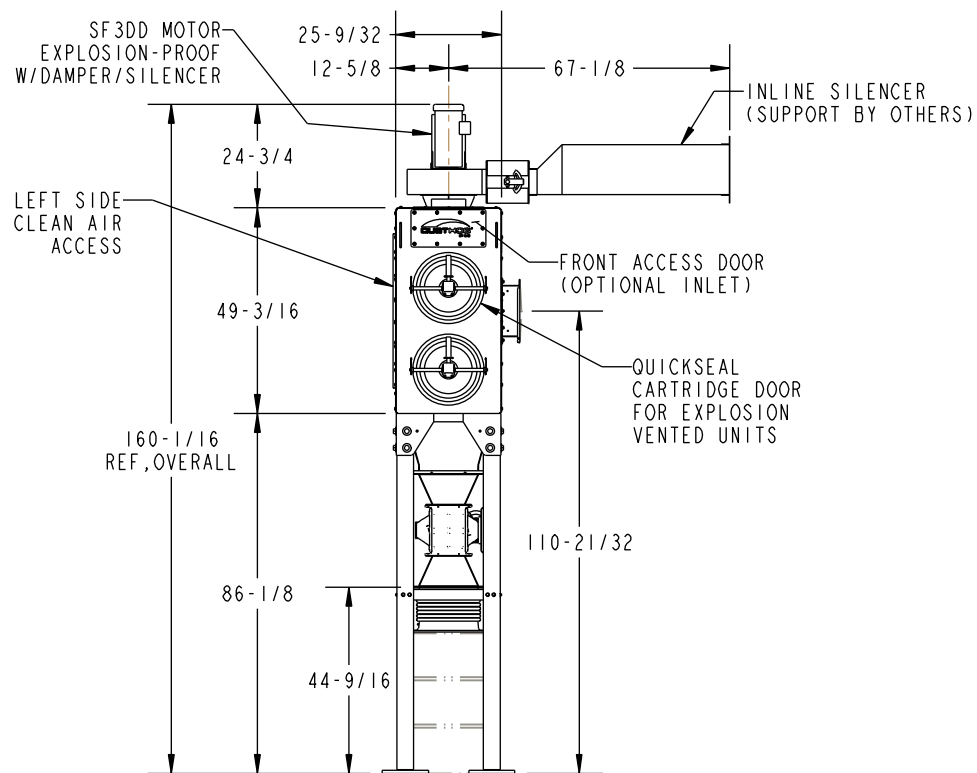
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THIS DRAWING IS NOT TO BE SCALED. FOR ADDITIONAL INFORMATION, PLEASE CONTACT OUR ENGINEERING DEPT.

REVISIONS				
LTR	ECN	DESCRIPTION	DATE	APPROVED
B	N/A	NOTES UPDATES PER CUSTOMER	04/11/17	AMM



- NOTES:
- SFC UNITS MUST BE ATTACHED TO IN-PLANT COMPRESSED AIR SUPPLY FOR CLEANING MECHANISM TO FUNCTION. (90-110 PSIG CLEAN DRY AIR)
  - VALVES AND CONTROL TIMER SYSTEM OPERATE ON 100/120V, 50-60 HZ POWER.
  - CABINET CONSTRUCTION: 10 GA MILD STEEL.
  - SOLID STATE PULSE CONTROL TIMER IN NEMA4 ENCLOSURE (ORDERED SEPARATELY).
  - PAINT PER SPEC - 09900
  - MAXIMUM K<sub>st</sub> VALUE = 234 BAR-m/SEC @ P<sub>max</sub> = 10 BAR
  - DPC PANEL: SHIPS LOOSE
  - MOTOR SPECS: EXPLOSION-PROOF; CLASS II, DIV I, GROUP G

SPECIFICATIONS:

- TOTAL FILTER AREA:
- TOTAL VALVES:
- TOTAL CARTRIDGES:
- TOTAL UNIT WEIGHT:
- SEISMIC ZONE:
- COMPRESSED AIR @ 100 PSIG

510 SQ FT  
2  
2 AT 13.8" DIA X 26" LG  
1031 LBS  
ZONE4, 100 MPH  
1.7 SCF PER PULSE  
(10.2 SCFM @ 6 PULSES/MIN)  
(90 PSIG ACCEPTABLE)

UNLESS OTHERWISE SPECIFIED:  
DIMENSIONS ARE IN INCHES.  
TOLERANCE:  
FRAC. DEC. ANGLES  
± N/A ± N/A ± N/A

SIGNATURES

MO-DA-YR

DESCRIPTION

**SFC2-2,45-DEG HOPPER  
EV,HSTD,ACLEVSMR,-40"**

SIZE

PART NUMBER

REV

A

D280339RA

B

SCALE:

0.022

SHEET 1 of 1



UNITED AIR SPECIALISTS  
CINCINNATI, OHIO

A

B

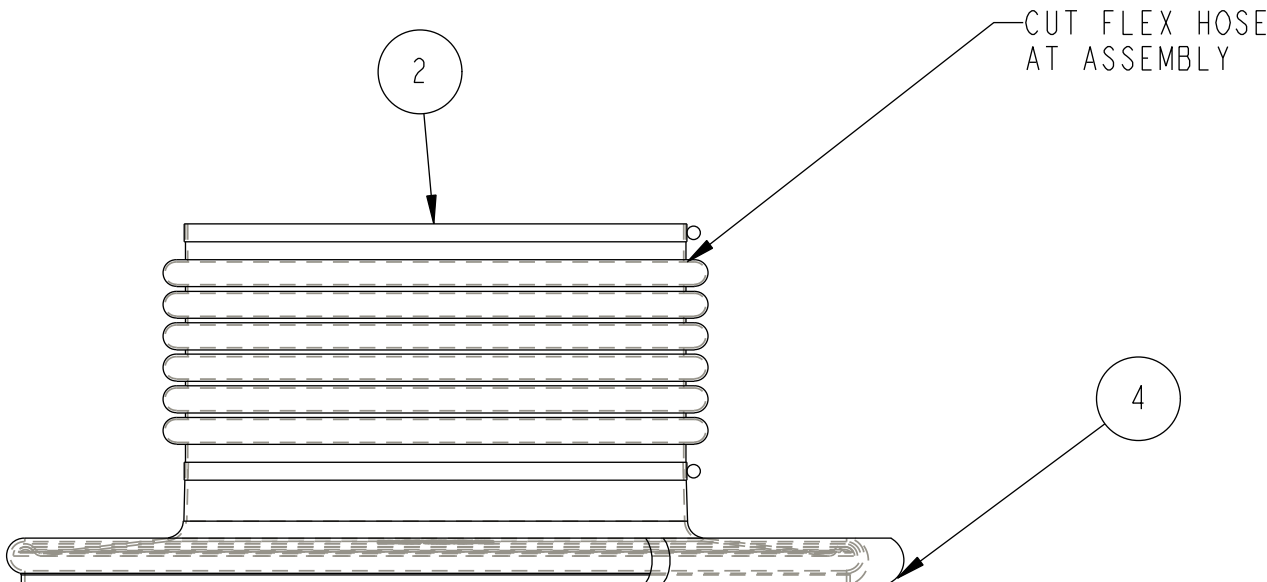
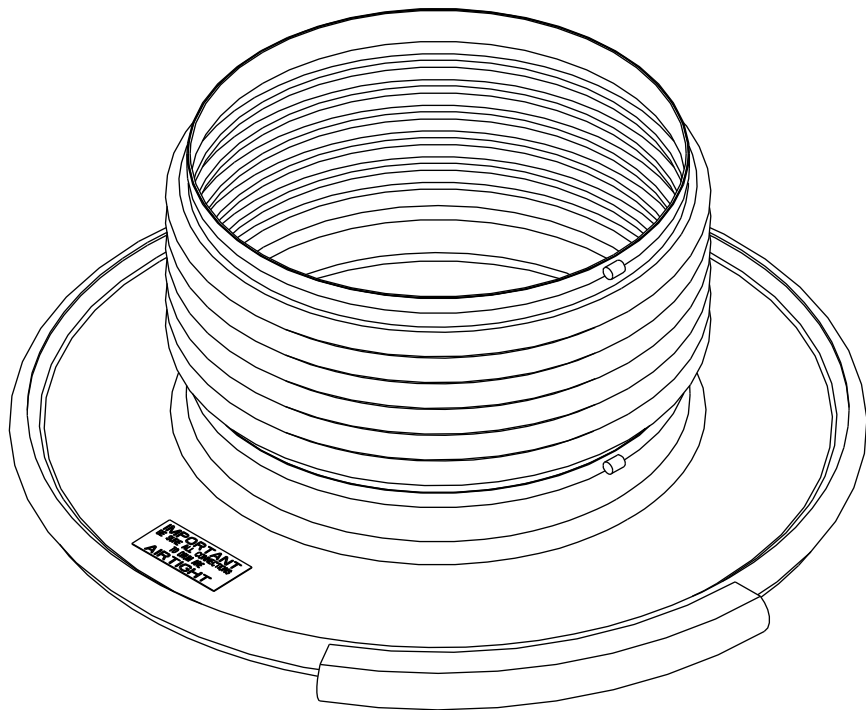
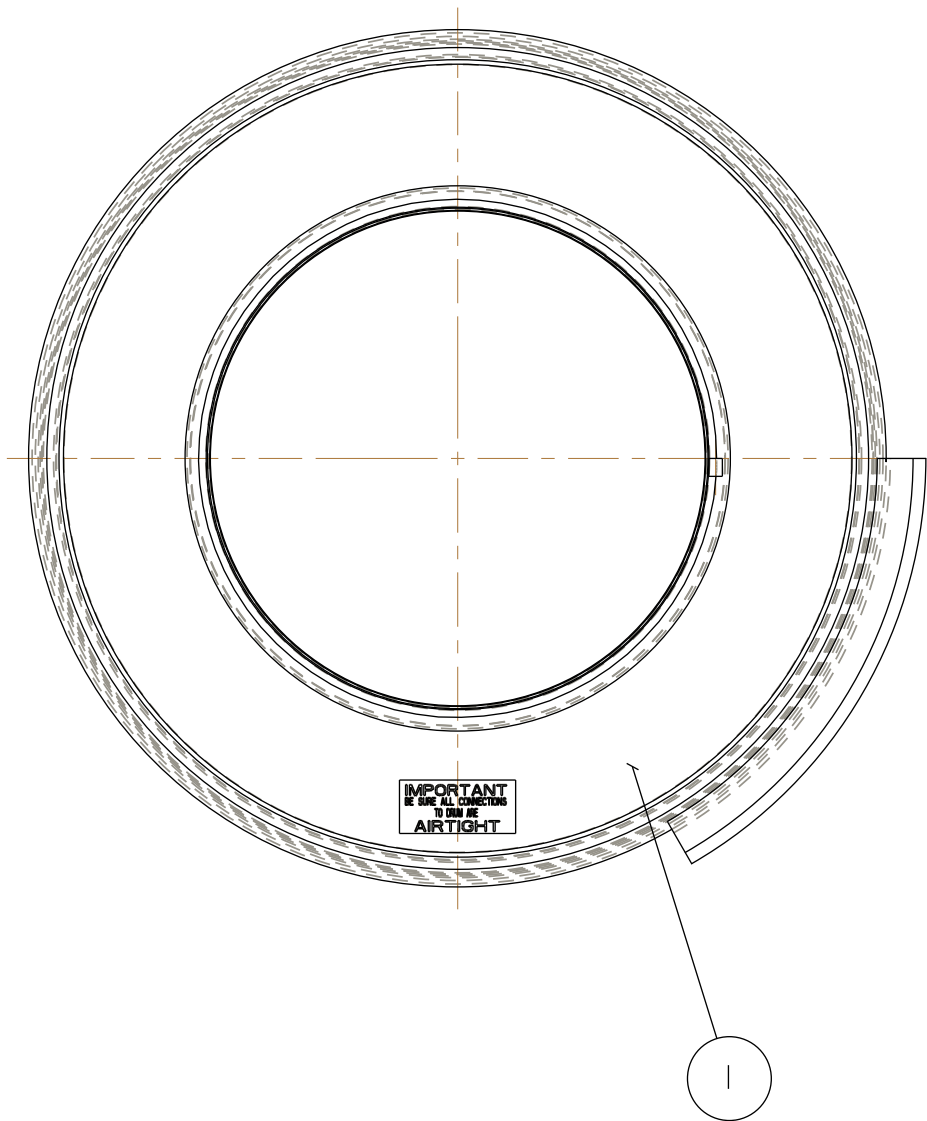
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D


E

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REVISIONS					
LTR	ECN #	DESCRIPTION	DRAWN	APPROVED	DATE
-	-	INITIAL RELEASE -ER2823	WDF	MAG	03/20/07



4	1	EA	45-10022-0055	DRUM, COLLAR, QUICK RELEASE, 55 GAL
3	1.25	FT	15-0202	DUCT, FLEX, 14 IN
2	2	EA	15-0233	CLAMP, HOSE, 14 IN
1	1	EA	02-10780-0055	ASM, DRUM LID, 55 GALLON, 14" ALUM.
ITEM	QTY	UM	PART NUMBER	DESCRIPTION

<b>CONFIDENTIAL</b> THIS DOCUMENT CONTAINS INFORMATION WHICH IS PROPRIETARY TO UAS, AND SHOULD BE PROTECTED ACCORDINGLY.				DESCRIPTION: DRUM LID LATCH KIT, 55 GALLON, 14" ALUM				
UNLESS OTHERWISE SPECIFIED PRIMARY DIM ARE IN INCHES. SECONDARY DIM ARE IN MM. TOLERANCE:  FRAC = ±1/32 [0.8] X.XX = ±0.03 [0.8] X.XXX = ±0.005 [0.1] ANGLE 12±2°	SIGNATURES		MO-DA-YR		REV:	SURFACE AREA: 2485.8 SQ. IN.		
	DRAWN: WDF		03/20/07		-	PART NUMBER:		
	CHECKED: MAG		03/20/07		SIZE:	03-1147-N		
	MATERIAL:		WEIGHT:		C	SCALE: 0.188		
			36LB/16KG			SHEET 1 OF 1		
3D GENERATED DRAWING								

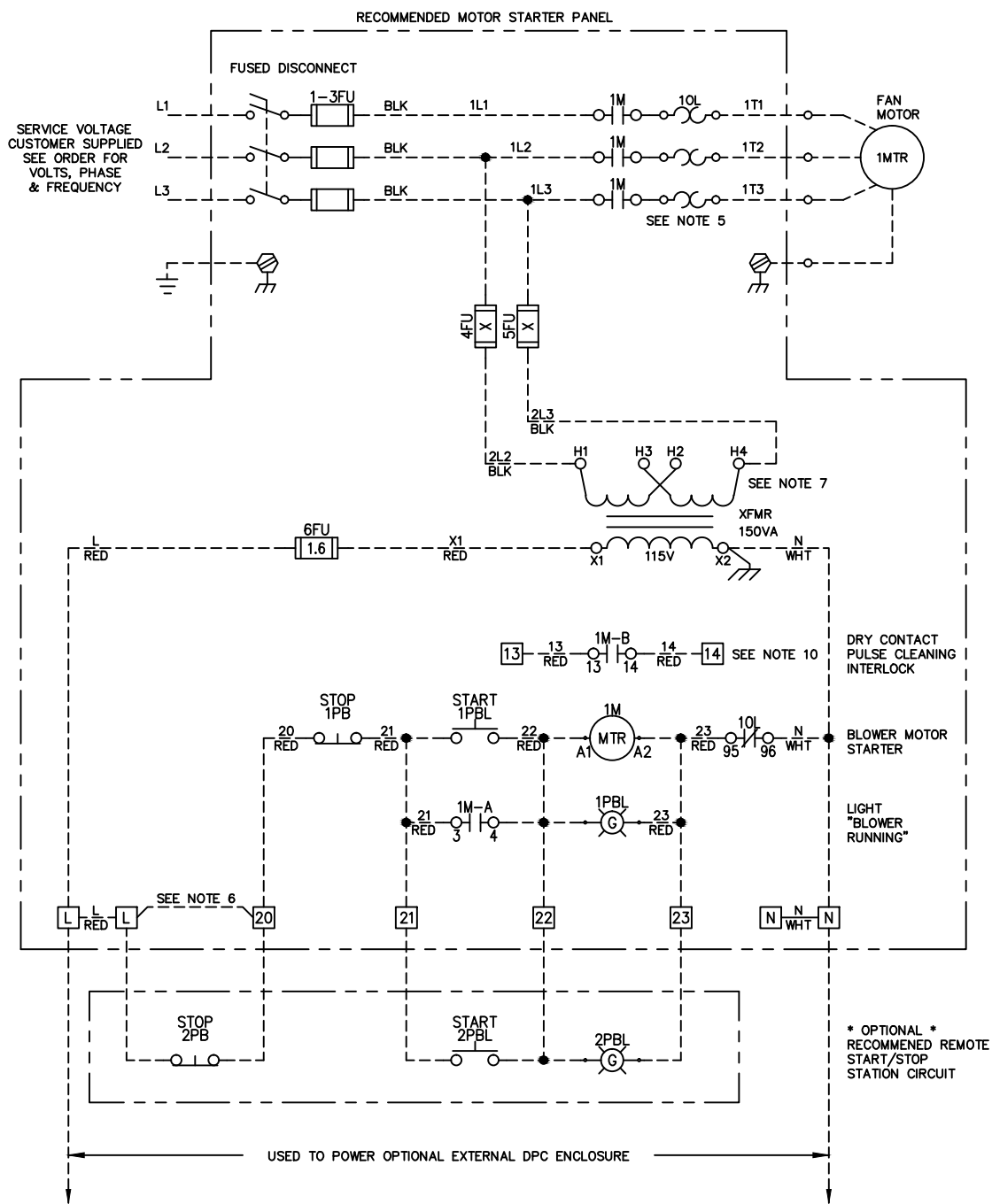
A

B

C

D

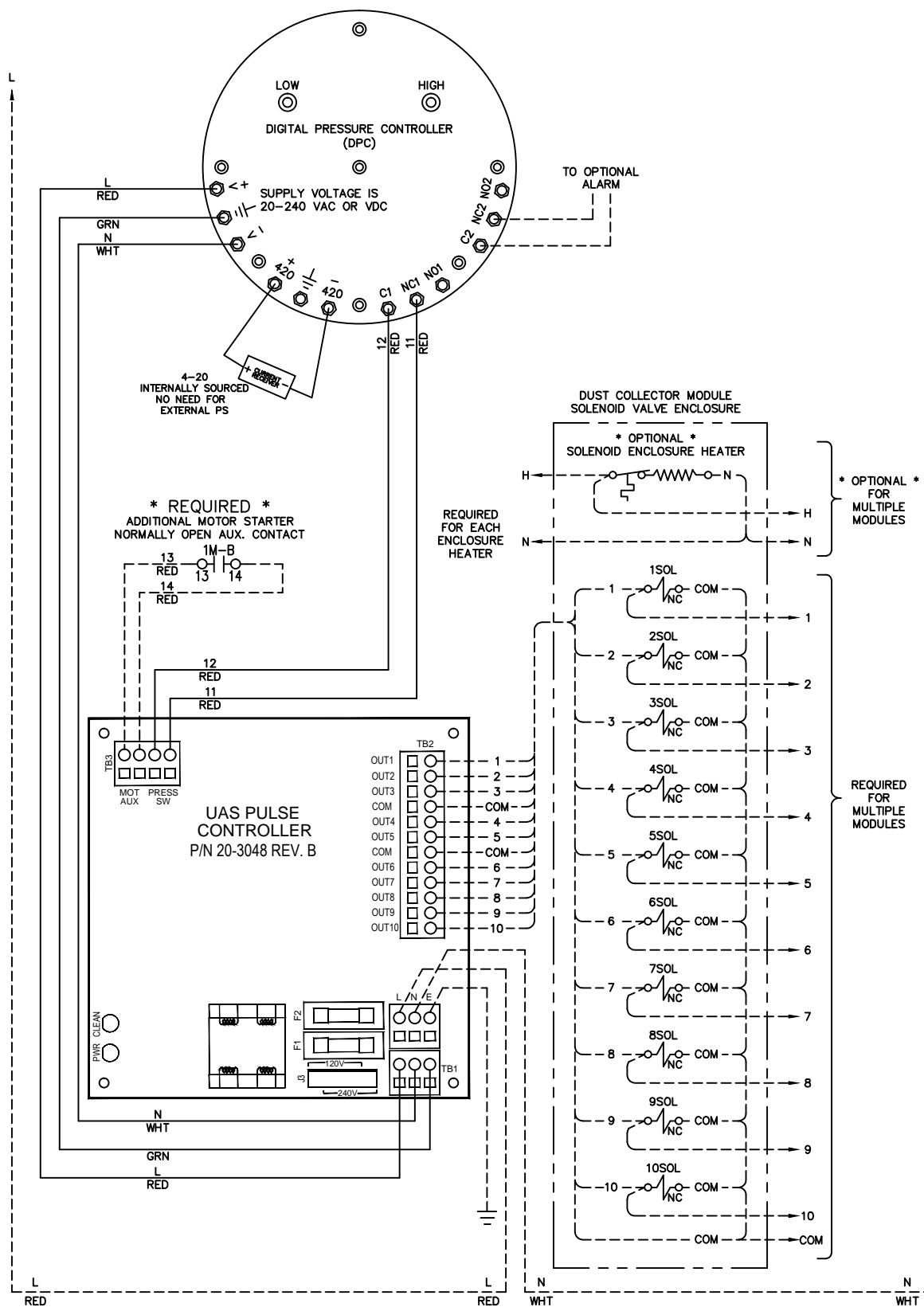
E



#### GENERAL NOTES:

- DASHED LINES INDICATE CUSTOMER OR OPTIONAL WIRING. - - - - -
- REFER TO ORDER FOR ADDITIONAL OPTIONS.
- CONTINUOUS LINES INDICATE MANDATORY WIRING OR WIRING SUPPLIED BY UAS.
- PHANTOM LINES INDICATE SEPARATE EQUIPMENT. - - - - -
- SET FLA ON OVERLOAD RELAY TO MATCH MOTOR NAMEPLATE FLA.
- REMOVE JUMPER BETWEEN "L" & "20" WHEN REMOTE START/STOP IS USED.
- WIRE APPROPRIATE TAPS ON PRIMARY OF CONTROL TRANSFORMER TO MATCH LINE VOLTAGE.
- ALL FIELD WIRING MUST BE COPPER WIRE WITH 60°C MINIMUM INSULATION.
- TORQUE TERMINAL BLOCKS TO 3-7LB-IN.
- DRY CONTACT 1M-B USED TO CONTROL THE OPTIONAL PULSE CLEANING SYSTEM.

□ INDICATES TERMINAL FOR CUSTOMER INTERCONNECTION.



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UNLESS OTHERWISE SPECIFIED:  
DIMENSIONS ARE IN INCHES.

TOLERANCE:  
FRAC. DECI. ANGLES  
± 1/32 ± .015 ± 1°

SIGNATURES  
DRAWN RER  
CHECKED

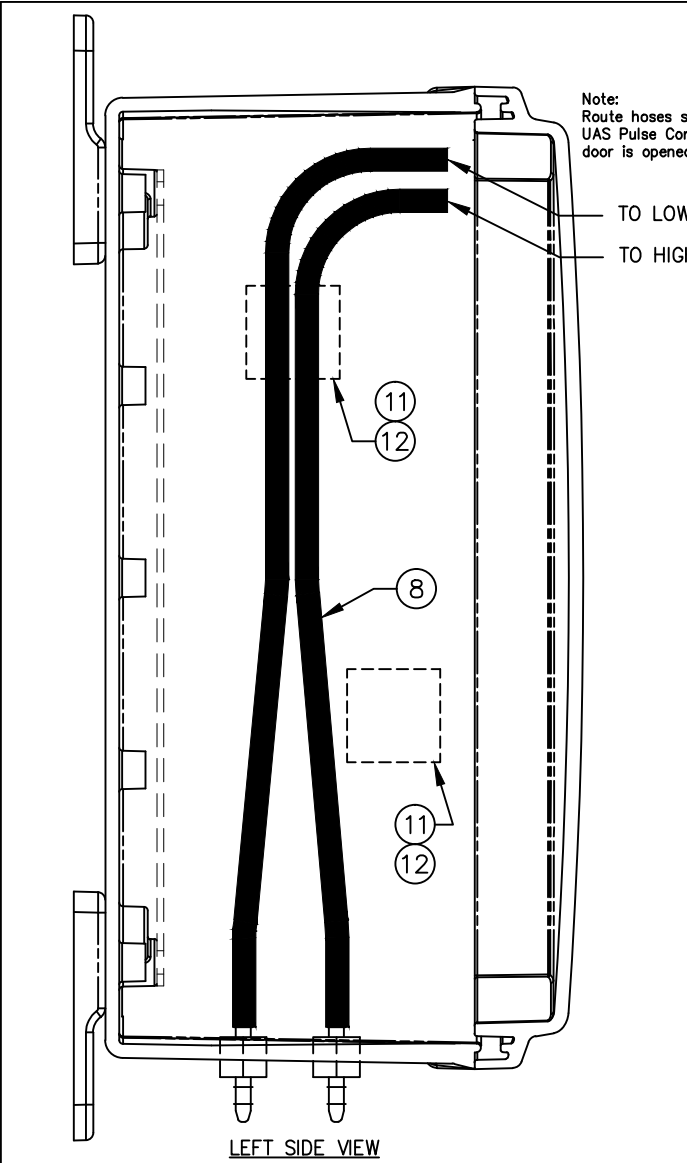
MO-DA-YR  
5/5/2015

THIS DRAWING IS NOT TO BE SCALED. FOR ADDITIONAL INFORMATION, PLEASE CONTACT OUR ENGINEERING DEPT.

W/D - DPC (W/4-20) & TIMER  
W/RECOMMENDED STR PNL

SIZE  
D E271388-01  
SCALE 1=1  
SHEET 1 OF 1





**DESCRIPTION:**  
Digital Pressure Controller in NEMA 4X panel. Measures cartridge differential pressure and activates pulse cleaning depending on the settings of the setpoint one, high and low. Activates an alarm output depending on the settings of setpoint two, high and low.

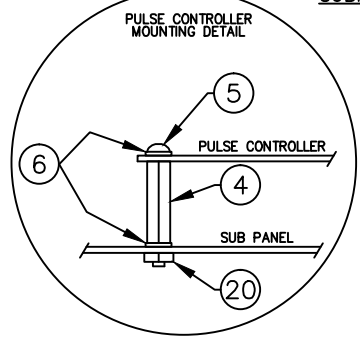
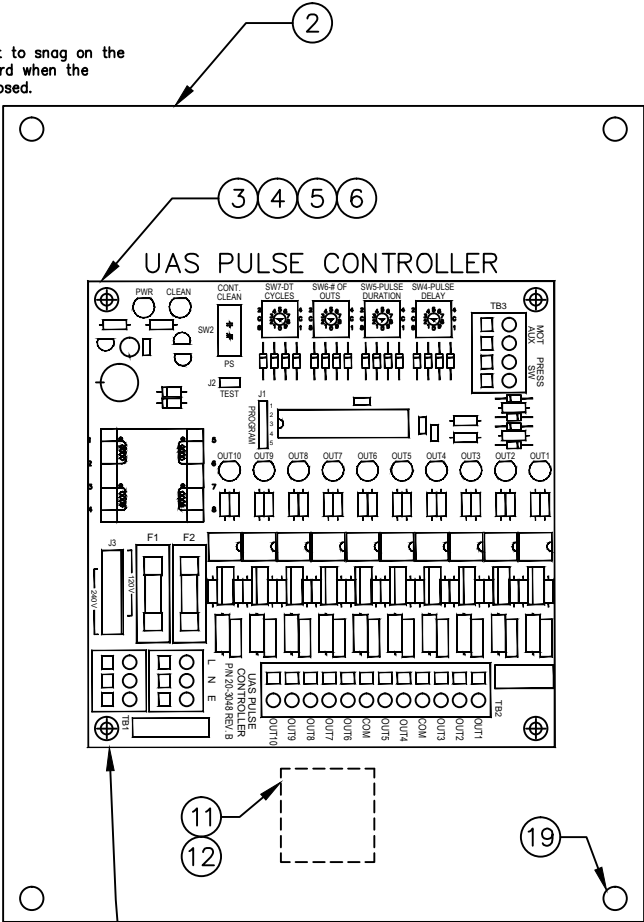
**UAS PULSE CONTROL BOARD SPECIFICATIONS:**  
Power Consumption: 150VA  
Voltage: 120 or 240VAC, 50/60hz  
Fusing: Logic, "F1" 250ma (time delay)  
Output "F2" 2A (time delay)  
Outputs: (Up to 10): 120 or 240VAC, 1.5A max, 50/60hz (triac)

**DIGITAL PRESSURE CONTROLLER SPECIFICATIONS:**  
Voltage Requirement: 20-240VAC/VDC, 50/60hz  
Range: 0"-X" In WC @ .01 increments, (X = Gauge part #)  
Temperature range: 10" to 140" F  
Relay Outputs (2): SPDT 8A @ 250VAC, 5A @ 30VDC  
Digital Display: 4 digit red 1/2" LED, LCD Programming display  
Process Arch Display: 20 LED's going from green to yellow to red  
Maximum Pressure: Ranges ≤ 4" W.C. = 2 PSI; Ranges ≥ 5" W.C. = 10 PSI  
Optional Feature: 4-20ma output signal

**UAS PULSE CONTROL BOARD FACTORY SETTING:**  
SW7 DT Cycles (Down Time): Position 0 (0 Down Time Cycles)  
SW6 # Of Outs: Position 0 (10 Valves) (Actual system may be less)  
SW5 Pulse Duration: Position 3 (100 Millisecond)  
SW4 Pulse Delay: Position 2 (10 Second Delay)  
SW2 Cleaning Mode: Set to PS (Pressure Switch)  
J3 Voltage Select Jumper: Set to 120VAC

**DIGITAL PRESSURE CONTROLLER FACTORY SETTINGS:**  
Setpoint 1 LO: 2.5" W.G.  
Setpoint 1 HI: 3.0" W.G.  
Setpoint 2 LO: 3.5" W.G.  
Setpoint 2 HI: 5.0" W.G.

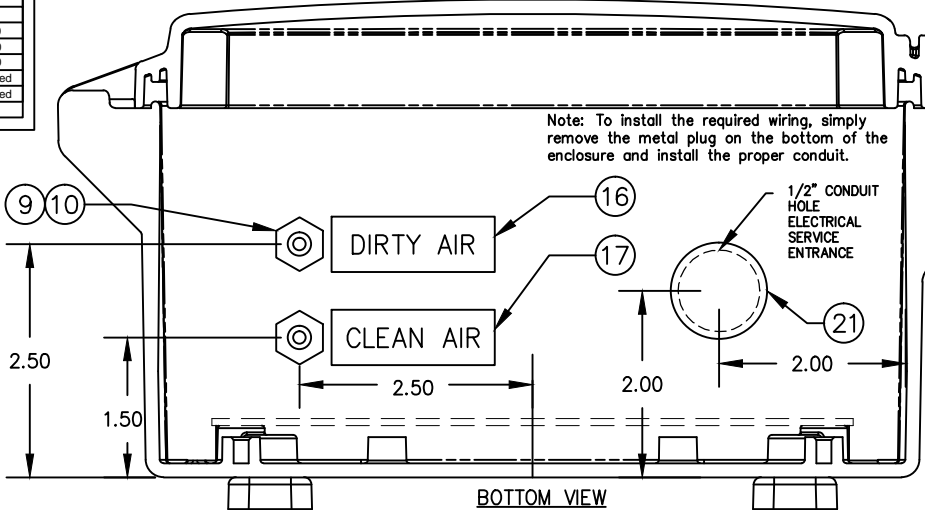
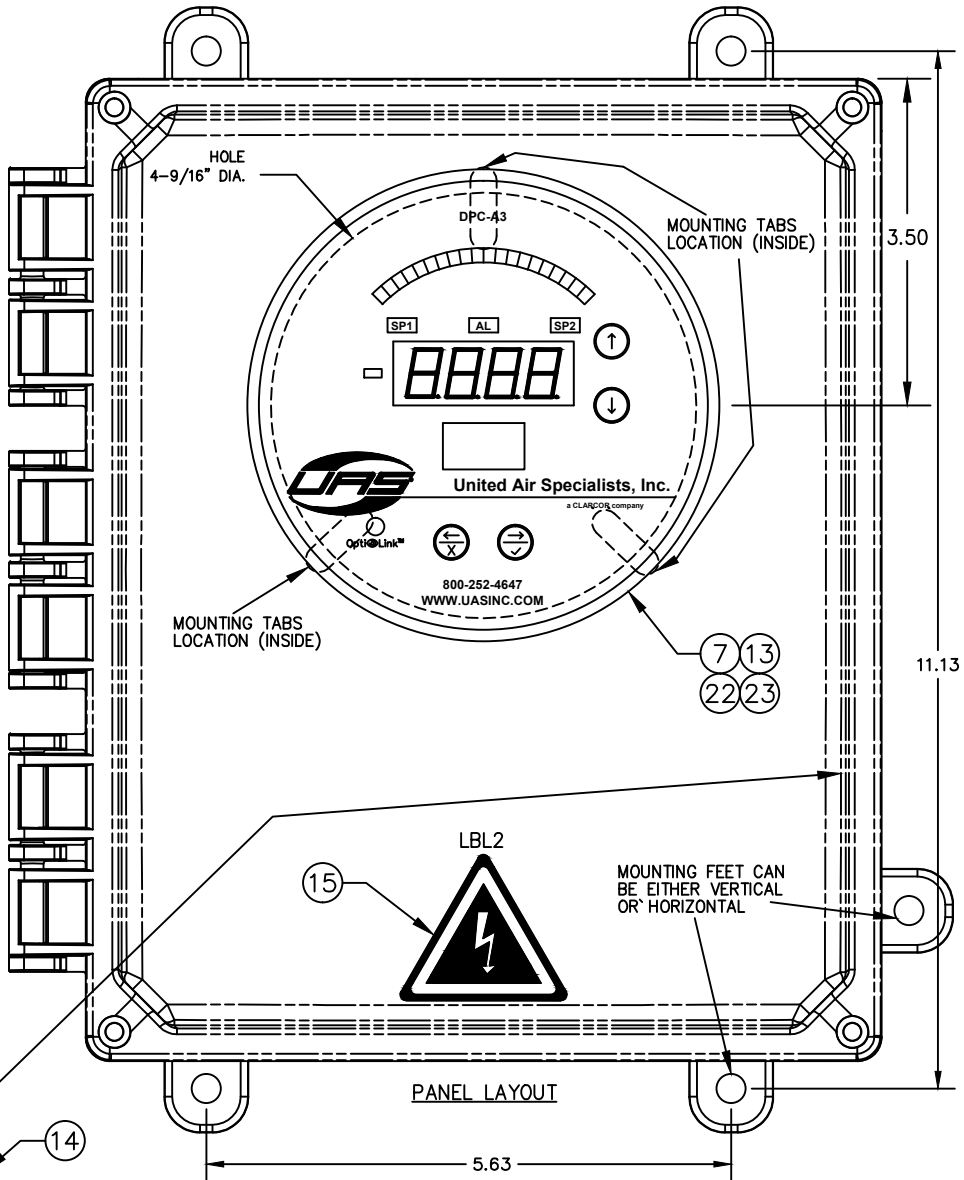
**GENERAL NOTES:**  
1. Refer to order for additional options.  
2. Dashed lines indicate optional, or customer wiring.  
3. Continuous lines indicate mandatory wiring, or wiring supplied by UAS.  
4. All field wiring must be copper wire with 60°C minimum insulation.  
5. A separate motor starter isolated dry contact must be supplied with the blower motor starter and wired to the UAS Pulse Control board "MOT AUX" terminals at TB3.



(LOCATED INSIDE OF ENCLOSURE)

Rotary Switch Position (SW7-4)	DT Cycles SW7	# Of Outs SW6	Pulse Duration (Sec.) SW5	Pulse Delay (Sec.) SW4
1	1	1	0.025	5
2	2	2	0.050	10
3	3	3	0.100	20
4	4	4	0.125	40
5	5	5	0.150	60
6	6	6	0.175	120
7	7	7	0.200	300
8	8	8	0.500	600
9	9	9	1.000	Unused
0	0	10	Unused	Unused

41-0000 Rev. B



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UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES.

TOLERANCE:

FRAC.	DECI.	ANGLES
+1/32	+ .015	+1°

SIGNATURES

MO-DA-YR

DRAWN MDS

12/18/2009

CHECKED

THIS DRAWING IS NOT TO BE SCALED. FOR ADDITIONAL INFORMATION, PLEASE CONTACT OUR ENGINEERING DEPT.

ASM, DIGITAL PRESSURE CONTROLLER W/ PULSE CONTROL BOARD, NEMA 4X

SIZE D

E271388KA

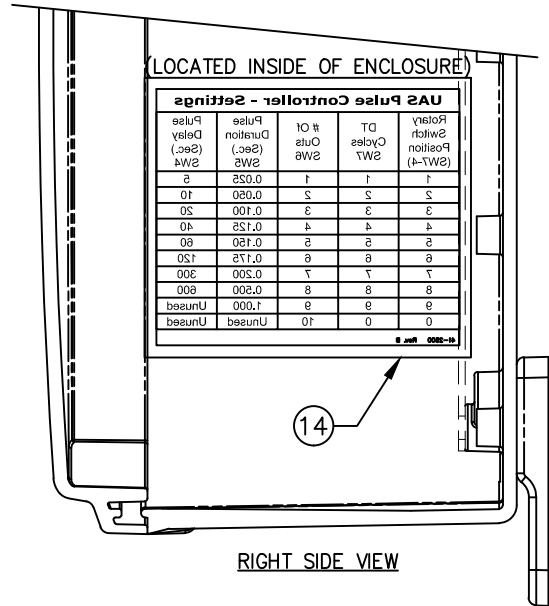
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SCALE 1=1

SHEET 1 OF 1

UAS

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED



#### GAUGE PART NUMBER AND DESCRIPTION

GAUGE MODEL:	W.C. RANGE:	GAUGE PART #:
01=0"-1"W.C.	01=0"-1"W.C.	07-10010-A301
02=0"-2"W.C.	02=0"-2"W.C.	07-10010-A302
03=0"-3"W.C.	03=0"-3"W.C.	07-10010-A303
04=0"-4"W.C.	04=0"-4"W.C.	07-10010-A304
05=0"-5"W.C.	05=0"-5"W.C.	07-10010-A305
08=0"-8"W.C.	08=0"-8"W.C.	07-10010-A308
10=0"-10"W.C.	10=0"-10"W.C.	07-10010-A310
15=0"-15"W.C.	15=0"-15"W.C.	07-10010-A315

ITEM	PART NO.	DESCRIPTION	QTY
1	20-10213	ENCLOSURE, 10"x8"x4" N4X, POLYCARB	1
2	20-10038-0002	PLATE, ENCL, 8-3/4 X 6-7/8	1
3	20-3048	UAS PULSE CONTROLLER, 10 OUTPUTS	1
4	30-1759	STANDOFF-7/8"Lx6-32,THREAD,1/4 HEX,M/F	4
5	30-0015	SCREW-MCH,HX,SLT,6-32 X 3/8 LONG,ZP	4
6	30-0038	WASHER-LCK,1TOOTH,#6,CDP M1070-6NWL,1,A	8
7	SEE CHART ABOVE	GAUGE, DIGITAL PRESSURE CONTROLLER, DPC-A3	1
8	20-10055-0001	TUBING, CLEAR	3.5'
9	20-2919-77	FITTING, BARB, 1/8"	2
10	42-0184	5/16 I.D. WASHER-BUNA N	2
11	20-0290	CABLE TIE, ADHESIVE MOUNTING BLOCK	3
12	20-0138	WIRE TIE, 5"	6
13	20-3109	SPIRAL WRAP, 1/4" O.D. T25F-C, PANDUIT	6"
14	41-2500	LABEL, UAS PULSE CONTROLLER	1
15	41-2432	LABEL, ELEC. SHOCK WARNING	1
16	41-2551	LABEL, PORT DESIGNATION, "DIRTY AIR"	1
17	41-2551	LABEL, PORT DESIGNATION, "CLEAN AIR"	1
18	44-10493-0001	OWNER'S MANUAL, PULSE CONTROL PANEL	1
19	30-0018	SCREW-MCH,RH,SLT,10-32 X 3/8 LONG,ZP	4
20	30-0001	NUT-MCH,HX,6-32,ZP	4
21	39-0070	PLUG-HOLE,7/8" DIA	1
22	03-10598-DG	WIRE KIT, DIGITAL PULSE PNL, GAUGE WIRES	1
23	03-10598-TB	WIRE KIT, DIGITAL PULSE PNL, TIMER BOARD	1
24	38-10172-25	TUBING-POLYETH,1/4"OD X.040 WALL BLACK, 25' LONG	1
25	E271388-01	W/D - RECOMMENDED STR PNL W/DPC (W/4-20) & TMR	1



## OWNER'S MANUAL

**Downward Flow Cartridge Dust Collector** | Model - SFC | PATENT NO: 6,902,592

DUST COLLECTION TANK.  
UAS MODEL: SFC2-2.  
TAG NUMBER: T-12-19.



*Clean air. It's what we do.<sup>®</sup>*

## KNOW YOUR EQUIPMENT

READ THIS MANUAL FIRST.

Your SFC system should provide many years of trouble-free service. This manual will help you understand the operation of your SFC unit. It will also help you understand how to maintain it in order to achieve top performance. For quick future reference, fill in the system and filter information in the spaces below. Should you need assistance, call the United Air Specialists, Inc. customer service number shown below. To expedite your service, have the following information available when contacting UAS.

UAS ORDER #: \_\_\_\_\_

UNIT MODEL #: \_\_\_\_\_

UNIT SERIAL #: \_\_\_\_\_

CARTRIDGE FILTER PART #: \_\_\_\_\_

SYSTEM ACCESSORIES:

---

---

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INSTALLATION DATE: \_\_\_\_\_

**UNITED AIR SPECIALISTS, INC. CUSTOMER SERVICE**

**1-800-252-4647**

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## SAFETY PRECAUTIONS

We have provided many important safety messages in this manual and on your SFC dust collector. Always read and obey all safety messages.



This is the safety alert symbol.

This symbol alerts you to potential hazards that can kill or hurt you and others. All safety messages will follow the safety alert symbol and the word “DANGER” “WARNING” or “CAUTION”. These words mean:



Indicates a hazardous situation which, if not avoided, will result in death or serious injury.



Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.



CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

## IMPORTANT SAFETY INSTRUCTIONS



To reduce the risk of fire, electric shock, or injury when using your air cleaner, follow these basic precautions:

- Wear protective clothing and safety glasses when handling collection filters or servicing the dust collector.
- Use proper lifting and rigging equipment to install your dust collector.
- The dust collector must be properly grounded.
- Disconnect power before servicing.
- Replace all access panels before operating.
- Electrical connections should only be made by qualified personnel, and be in accordance with local and national codes and regulations.
- Do not use in explosive atmospheres unless the dust collector is equipped with the appropriate accessories.
- Keep flammable materials and vapors, such as gasoline, away from dust collector.
- The unit should be inspected frequently and dirt removed to prevent excessive accumulation which may result in flash-over or fire damage.
- The SFC system should not be used to support personnel or material.
- Operate only in a safe and serviceable condition.
- Do not allow any individual to put lit cigarettes or any burning objects into any hood which is ducted into the dust control system.

## 1. IMPORTANT NOTICE

This manual contains important safety information and precautionary measures. It is impossible to list all potential hazards associated with every dust collection system in each application. Proper use of the equipment should be discussed with United Air Specialists, Inc. (UAS) or your local UAS representative. Operating personnel should be aware of, and adhere to, the most stringent safety procedures.

### **DANGER** **EXPLOSION HAZARD**

- Avoid mixing combustible materials such as aluminum, paper, wood or other organic dusts with dusts generated from grinding materials. A fire hazard could develop from sparks entering the dust collector. When collecting flammable or explosive materials, the dust collector should be located outdoors and incorporate the appropriate safety measures and/or accessories.
- When collecting emissions from spark-producing processes, care must be taken to reduce any potential fire hazards. System design should include methods to prevent sparks from entering the dust collector. Dust collectors do not contain fire extinguishing equipment unless specifically ordered. Experts in the field of fire extinguishing equipment should be consulted for recommendations concerning proper fire detection and suppression systems.
- Some dust collection systems require explosion venting. Consult your insurance underwriter, NFPA (National Fire Protection Association) manual and your local fire authorities to determine the requirements for explosion venting.
- Be careful and conscientious – consult national and local fire codes, waste disposal, safety and other appropriate authorities. Comply with their recommendations for the proper installation and operation of dust collection equipment.
- Your dust collector was selected for a particular application. Consult UAS prior to making any application or system changes.
- All explosion vent installations should be located to allow full-unrestricted discharge when system pressure exceeds the set pressure of the explosion vent. An explosion vent should never be located where the discharge from the vent will impact people or plant equipment.
- Do not use the explosion vent as temporary work surface for hand tools; i.e., wrenches, screw drivers, etc. Such actions can cause premature failure to occur via over stressing the explosion vent.
- **All dust collectors handling hazardous or fire/explosion risk dust, as determined by the user, are recommended to be located outside the building in non-traffic areas even though the dust collector is equipped with an explosion vent.**

## 2. INTRODUCTION

Thank you for selecting UAS dust collection equipment to assist you in your commitment to a clean and safe environment. We trust that in purchasing our product, you have recognized our commitment to continually offer air cleaning equipment engineered to each dust collection need and manufactured to the highest standards. If at any time you have a question about dust collection, please do not hesitate to call your local UAS representative.

The SFC is designed to collect process generated dusts. The optimized pulse cleaning system coupled with the QuickSeal filter access doors provide the most dependable and maintenance friendly cartridge collector in the market.

The SFC dust collector should not be used for any purpose not listed in this manual.

As you review this manual, refer to Figure 1 for assistance in identifying dust collector parts. The SFC Specification Table in Section 3 provides additional unit information.

### 2.1 UNIT NOMENCLATURE

#### Example: SFC8-2-H55

SFC2-2

SFC = Model collector

8 = number of cartridge filters

2 = number of filter tiers

H55 = unit base arrangement

H55 - hopper with 44" (112 cm) clearance for standard 55 gallon (208 liter) drum

SD - hopper with 28" (66 cm) clearance for UAS-supplied 20 gallon (76 liter) drum

OB - open bottom construction

BV - custom bin vent unit with open bottom

DD - dust drawer

### 2.2 DESCRIPTION AND OPERATION

The SFC is a high-efficiency cartridge dust collector designed to eliminate airborne dust as it is generated. Contaminants are captured at the source(s), then conveyed through ducting to the cartridge filter section (dirty air section) where the dust is collected. Clean air is then discharged from the unit through the clean air discharge.

The dust collector is designed for on-line or downtime cartridge filter cleaning by means of a customer-supplied compressed air system.

The SFC is a high-efficiency, horizontally-oriented cartridge dust collector equipped with 9.48" I.D. and 13.87" O.D. cartridge filters. The larger diameter ProTura® Nanofiber cartridge filter design allows for lower pressure losses through the dust collector while increasing the amount of media contained in each filter. SFC Series dust collectors have pre-engineered backward-inclined or radial-type optional blower packages in 2, 3, 5, 7-1/2, 10, 15, 20, 25 and 30 hp (1.5, 2.2, 3.7, 5.5, 7.5, 11, 15, 18.8, 22.6 kW) assemblies.

There are two primary modes of operation — the air filtering operation and filter cleaning cycle. Both modes of operation are shown in Figure 1.

## 2.3 AIR FILTERING OPERATION

The contaminated airstream is drawn into the dust collector where its velocity is reduced by inlet baffle plates to provide even air distribution across the entire surface area of the cartridge filters. This design enhances filtration efficiency by establishing a uniform “dust cake” on the filters. The airstream is then directed around the cartridge filters and down toward the hopper, where the heavier particles discharge to the dust storage drum.

The contaminated air then passes through the cartridge filters. The filter media strips the dust from the airstream, allowing only clean air to pass through the cartridge filter. The air then passes into the clean air plenum, through a blower package and is discharged from the unit.

compressed air, directed through the diaphragm valves, toward the cartridge filter. This pulsing action dislodges the collected particles from the media, where they fall into the hopper and are discharged to a dust storage drum or drawer.

During the cleaning cycle, each pair of cartridge filters is cleaned individually. The solid-state sequential timer actuates a solenoid valve, which allows an air diaphragm valve to open for approximately 100 milliseconds. High-pressure air from the air manifold reservoir is directed through the diaphragm valve toward the venturi mounted on the tubesheet in front of the cartridge filters. The venturi, in conjunction with the DIF nozzle, maximizes the compressed air energy to maximize the amount of collected dust released from the filter surface.

The dislodged dust removed from the filter is swept downward into the hopper. The remaining filters are cleaned sequentially. The sequencing is factory preset at 10-second intervals and is adjustable to adapt to your particular cleaning needs.

## 2.4 FILTER CLEANING CYCLE

During normal operation, the surface of the cartridge filters become loaded with contaminants. The reverse-pulse cleaning mechanism provides brief bursts of

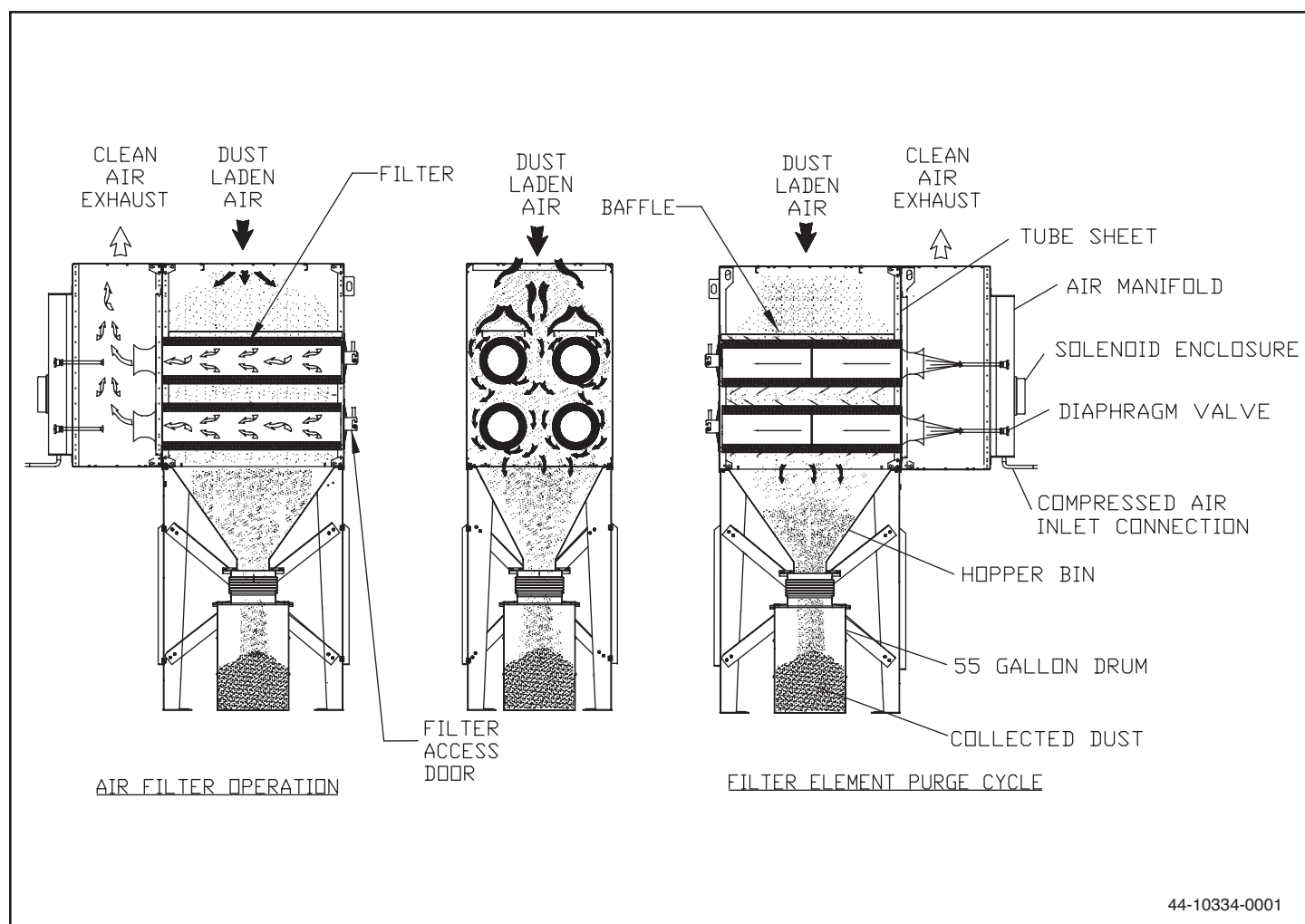


FIGURE 1  
SFC Air Filter Operation & Cleaning

### 3. INSTALLATION

#### 3.1 OFF LOADING AND INSPECTION

SFC dust collector modules are shipped assembled (with cartridges installed) on skid(s). Other skids will contain the hopper/leg assembly and other components. Other accessories (afterfilter assemblies, blower packages, dust storage drums, silencers, etc.) may be on additional, separate skids.

#### **DANGER** **TIP OVER HAZARD**

Lift the dust collector components by the packing skids or use the external lifting lugs provided on the filter module. Do not lift the filter module of the dust collector by placing lift truck forks through the cartridge filter access doors. The filter support rails or venturi installed on the tubesheet could be damaged.

Upon receipt of your unit, check for any shipping damage. A damaged carton indicates that the equipment may have received rough handling during shipping that may have caused possible internal damage. Notify your delivery carrier and enter a claim if any damage is found.

#### 3.2 INSTALLATION PLANNING

The proper location of your dust collection equipment is very important. Refer to Figures 2 and 3 for typical installation details.

Certain items should be considered when locating the unit, such as emptying of the dust storage drum(s), filter removal requirements, compressed air connections, access to the clean air plenum, electrical connections, blower location and discharge direction. The shortest duct length with a minimum number of elbows will maximize the performance of the unit. Ease of maintenance should also be considered when selecting the location and orientation of the system. Refer to Figure 3 for recommended clearances.

#### **DANGER** **EXPLOSION HAZARD**

In the case of spark producing processes, system design should incorporate measures to prevent live sparks from entering the dust collector. Consult local authorities for the location of the unit and any additional precautions to consider when collecting combustible, explosive or hazardous dusts. General warnings and cautions are provided on page iii and in Section 1.

#### **DANGER** **TIP OVER HAZARD**

The SFC dust collector should be mounted on a solid, level, reinforced concrete foundation. Other mounting

options are also possible. Structural calculations for the foundation or other mounting arrangements must include the weight of the collected material and the weight of all auxiliary equipment installed with the dust collector (ducting, abrasive inlet, blower package, afterfilter assembly, etc.). These weights must be considered together with wind loading, seismic loading and other live load ratings when designing the dust collector foundation support structure. Consult a professional engineer when designing the foundation for the unit.

The system should be designed with the ability to regulate airflow. Two common ways to do this are through the use of flow/volume control dampers or variable frequency drives to control the speed of the fan motor. UAS offers both of these options. If flow control dampers are selected, the interconnecting duct work should be designed to account for the installation of said damper. These dampers can be installed on the inlet or outlet ducting of the SFC unit. Whether you control the flow through the use of a damper or VFD, the ductwork must be properly sized to meet the recommended air velocities for the material being collected.

Follow ducting design methods as listed in the *Industrial Ventilation Manual* as recommended by the American Conference of Governmental Industrial Hygienists.

#### 3.3 ASSEMBLY OF STANDARD EQUIPMENT

#### **DANGER**

##### **CRUSH AND ELECTROCUTION HAZARD**

Use adequate safety measures when lifting and assembling any heavy components. Consult your plant safety personnel for recommendations.

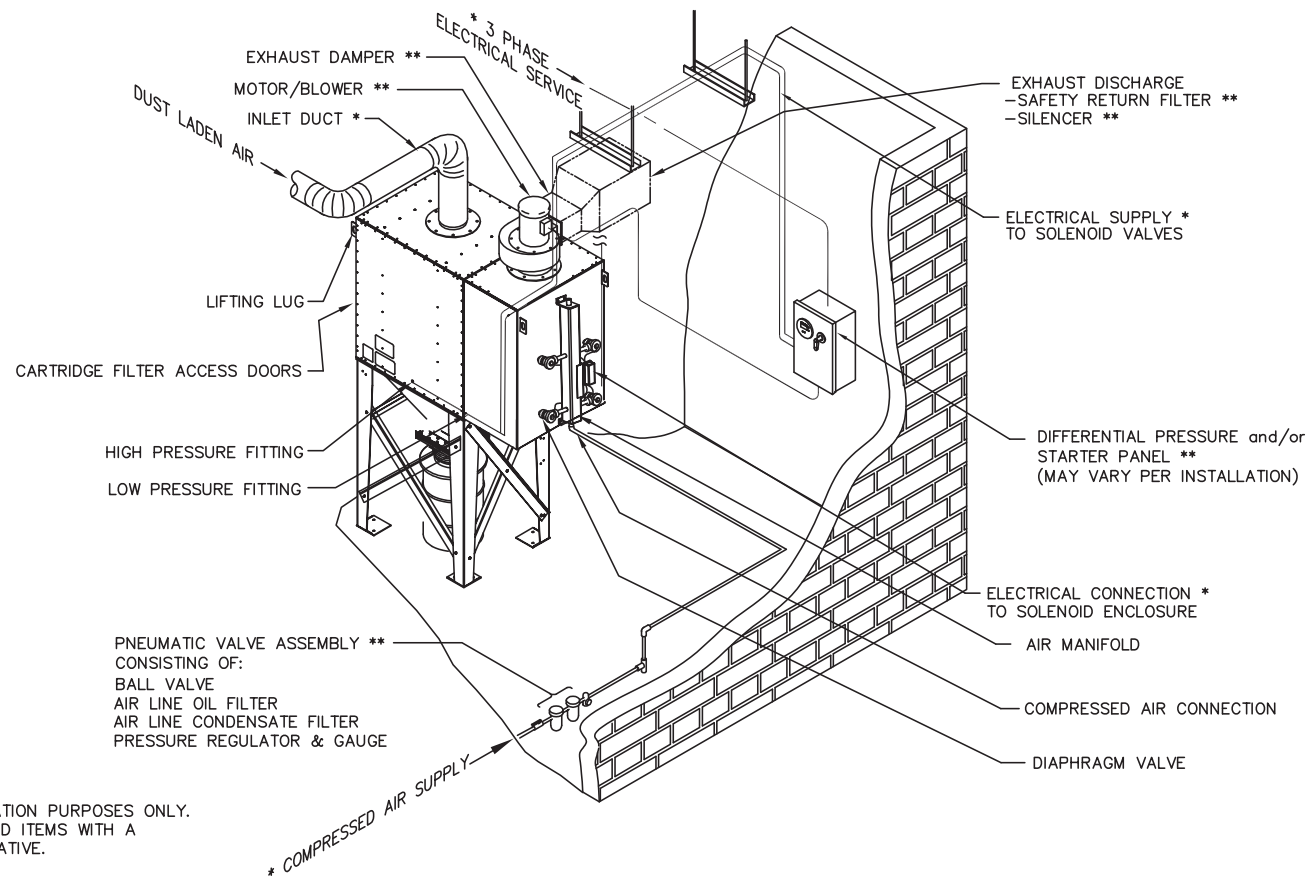
In preparing to attach the filter module to the hopper, connect lifting slings and spreader bars to all filter module lifting lugs with clevis pins. Use spreader bars to distribute the load evenly. Location must be clear of all obstructions, such as utility lines or roof overhangs.

Remove all crating, strapping and hold-down bolts. Locate all hardware bags, sealant and other assembly materials provided with your unit.

##### 3.3.1 HOPPER ASSEMBLIES

The SFC Series filter module is designed to mount directly on top of the hopper assembly. A hopper assembly consists of a hopper bin, legs, side diagonal sway braces, rear diagonal sway braces and the hardware installation kit. Hopper assemblies will be shipped in pieces and will need to be assembled at the site.

The hopper sections are shipped in pieces for field assembly. Position the legs as shown in Figure 4 for single module hopper assembly, or Figure 5 for multi-modular hopper assemblies.

**NOTE:**

UNIT & LAYOUT IS FOR REPRESENTATION PURPOSES ONLY.  
CONFIRM ALL NECESSARY PURCHASED ITEMS WITH A  
UNITED AIR SPECIALISTS REPRESENTATIVE.

**LEGEND**

- \* ASTERISK DENOTES ITEMS NOT FURNISHED BY UNITED AIR SPECIALISTS
- \*\* DOUBLE ASTERISK DENOTES ITEMS AVAILABLE FROM UNITED AIR SPECIALISTS AS AN OPTION.

44-10335-0001

**FIGURE 2**  
**SFC Typical SINGLE UNIT Installation Diagram**

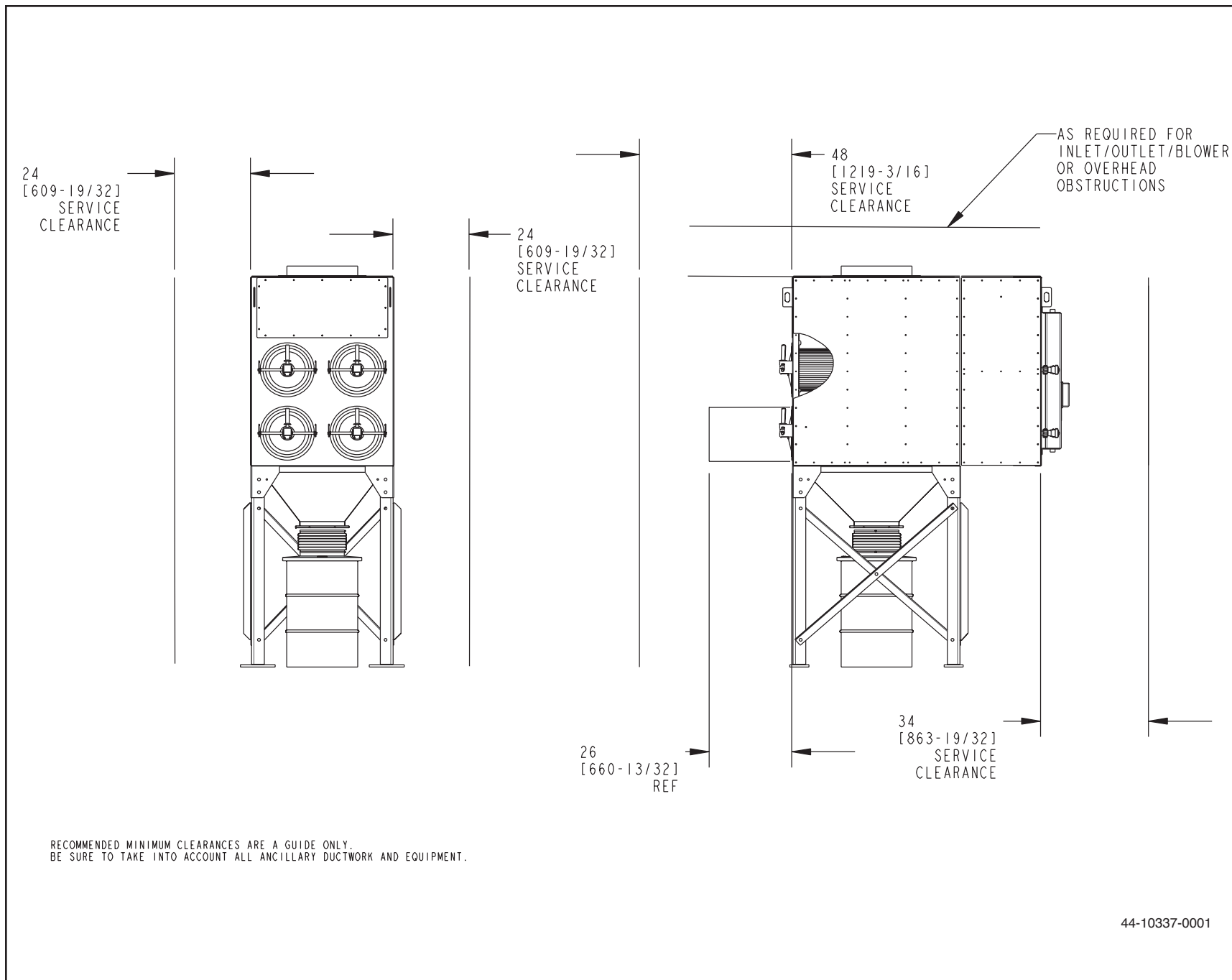


FIGURE 3  
Recommended Unit Clearances



### 3.3.1.1 SINGLE MODULE HOPPER ASSEMBLY

Assemble four leg weldments to hopper (refer to Figure 4, Detail A), making sure base pads are oriented as illustrated. After four legs have been bolted to the support hopper, locate the four support braces which measure 60-11/16" between hole centers, and attach to left and right side of hopper legs as shown in Figure 4. Locate the two support braces, which measure 55-1/16" between hole centers. These braces are to be attached to back legs as illustrated in Figure 4.

After all support braces have been installed. Bolt brace together as illustrated in Fig. 4, Detail B.

#### **WARNING**

Secure hopper/leg assembly to concrete mounting pad with appropriate mounting hardware. Anchors should be provided by customer or contractor according to local codes.

### 3.3.1.2 MULTIPLE MODULAR HOPPER ASSEMBLIES

Position multiple hoppers side by side and bolt through corner gussets as illustrated in Figure 5, Detail D. After hoppers have been securely fastened, refer to Figure 6 to locate your hopper configuration. Using this configuration and Figure 5, Detail E, locate and attach the leg weldments to the hopper assembly. Locate the diagonal support brace which measures 60-11/16" and attach it to the hopper corner brackets on left and right side of hopper referencing Figure 5 hopper configuration and Figure 6, making sure the base pads are oriented as illustrated in Figure 6. Locate the support braces, which measure 55-1/16" between hole centers. These braces are to be attached to the back legs as illustrated in Figure 5, Details A and C.

After all support braces have been installed, bolt side braces together where they cross as illustrated in Figure 5, Detail B.

#### **WARNING**

Secure hopper/leg assemblies to concrete mounting pad with appropriate mounting hardware. Anchors should be provided by customer or contractor according to local codes.

### 3.3.2 FULLY ASSEMBLED FILTER MODULE SECTIONS

Apply two ribbons of sealant to hopper flange to create "figure 8" pattern around mounting holes. Refer to Figure 7, Detail A.

Place filter module onto hopper/leg assemblies (refer to Figure 7). Drift pins will also be useful for locating the filter module section onto the hopper.

**NOTE:** Each hopper assembly is equipped with four 1/2" (13mm) pry locations – two holes on front flange and two holes on rear flange. Refer to Figure 7, Detail C, to aid in aligning the hopper flange with the module flange.

With filter module still supported, use hardware (refer to Figure 7, Detail A) to bolt the hopper and filter module together. Securely tighten all hardware at the filter module and hopper. Recheck leg assembly sway braces to ensure they are tight. Install fasteners (bolt, flat washer, lock-washer, nut) to all four pry locations.

Disconnect lifting slings and spreader bars used for installation.

### 3.3.3 MULTIPLE, BOLT-TOGETHER MODULE SECTIONS (APPLIES TO 4 OR MORE MODULES)

For units that have multiple bolt-together module sections, remove the row of filters from the modules nearest the bolting flange (refer to Section 5.1). Protect the doors and filters removed by placing in a safe area away from work area. Identify the different module sections. There are left (bolt flange on right side), right (bolt flange on left side) and possibly center (bolt flanges on both sides) module sections.

Install all hopper/leg assemblies as previously described in Section 3.3.1.1 and 3.3.1.2.

Apply two ribbons of sealant to hoppers that are located under the dust collector section that is being installed (refer to Figure 7, Detail A).

#### **DANGER**

#### **CRUSH AND ELECTROCUTION HAZARD**

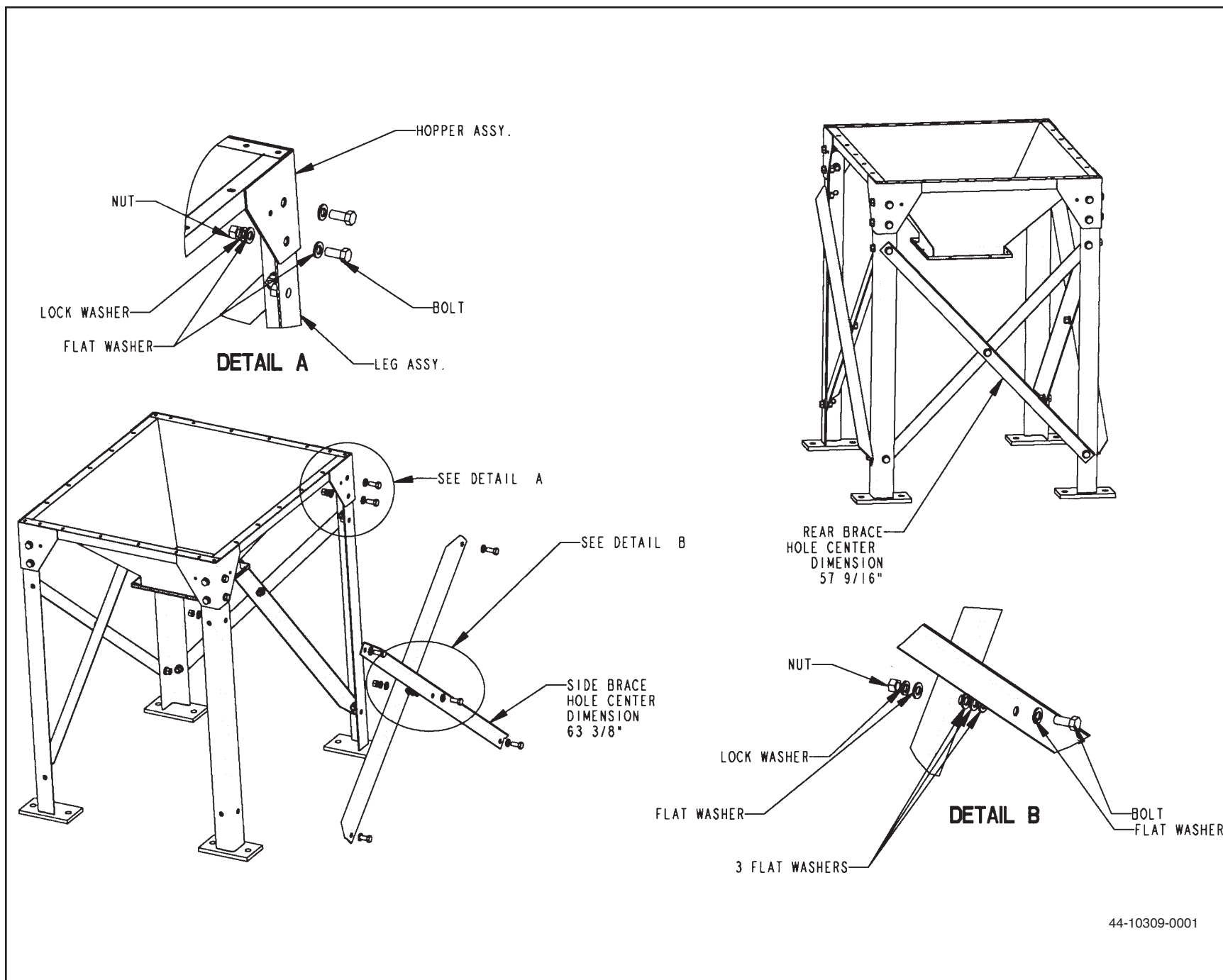
In preparing to attach the filter module to the hopper, connect lifting slings and spreader bars to all filter module lifting lugs with clevis pins. Distribute the load evenly. Location must be clear of all obstructions, such as utility lines or roof overhangs.

Place the appropriate filter module onto hopper/leg assembly to which the sealant has been applied, positioning filter module corner holes over alignment holes (refer to Figure 7, Detail C). Drift pins will also be useful for locating the filter module section onto the hopper.

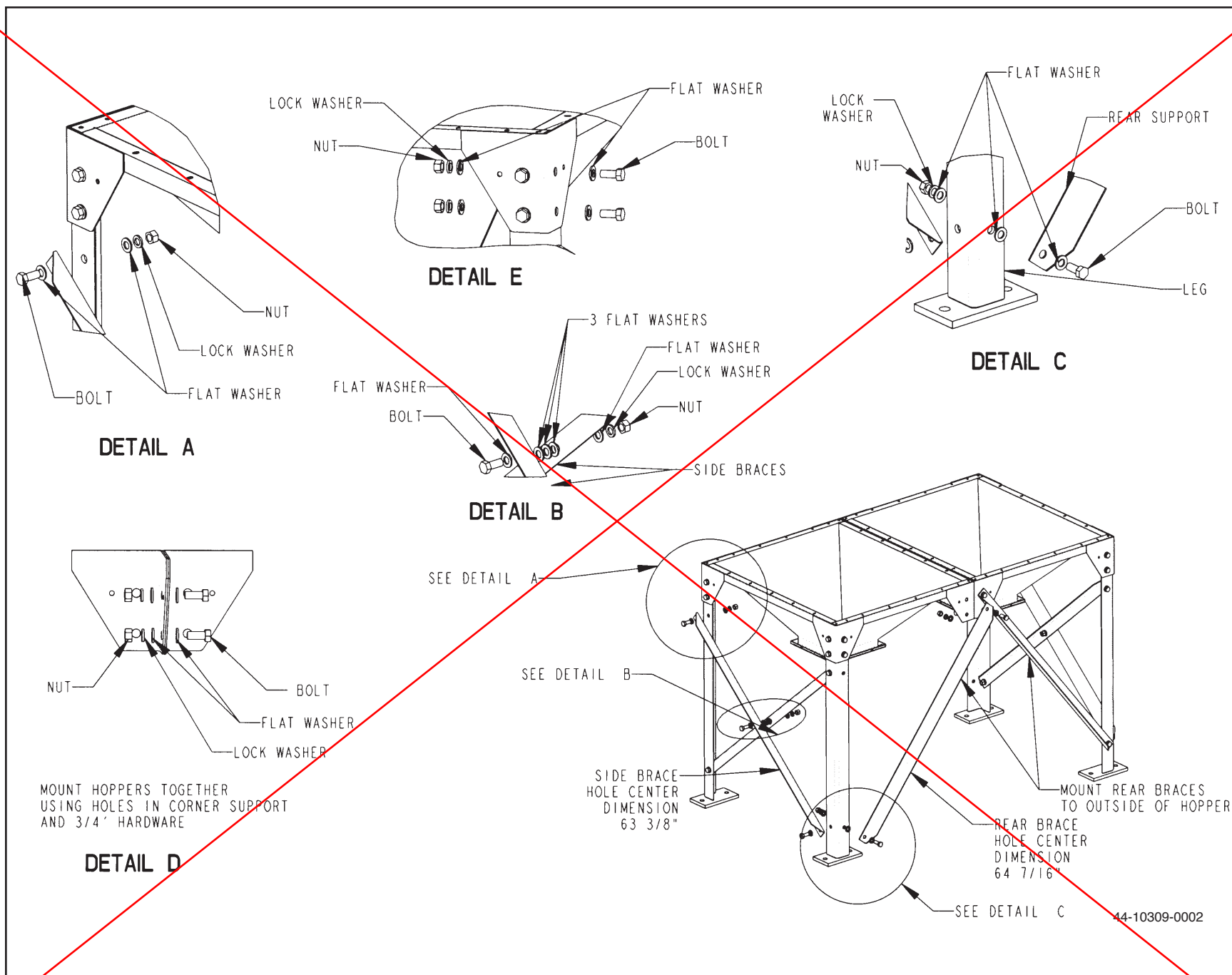
**NOTE:** Each hopper assembly is equipped with four 1/2" (13mm) pry locations – two holes on front flange and two holes on rear flange. Refer to Figure 7, Detail C, to aid in aligning the hopper flange with the module flange.

With filter module still supported, use hardware (refer to Figure 7, Detail A) to bolt the hopper and filter module together. Securely tighten all hardware at the filter module and hopper. Recheck leg assembly sway braces to ensure they are tight. Install fasteners (bolt, flat washer, lock-washer, nut) to all four pry locations. 6





**FIGURE 4**  
**Single Hopper, SFC**



**FIGURE 5**  
Multiple Hopper, SFC

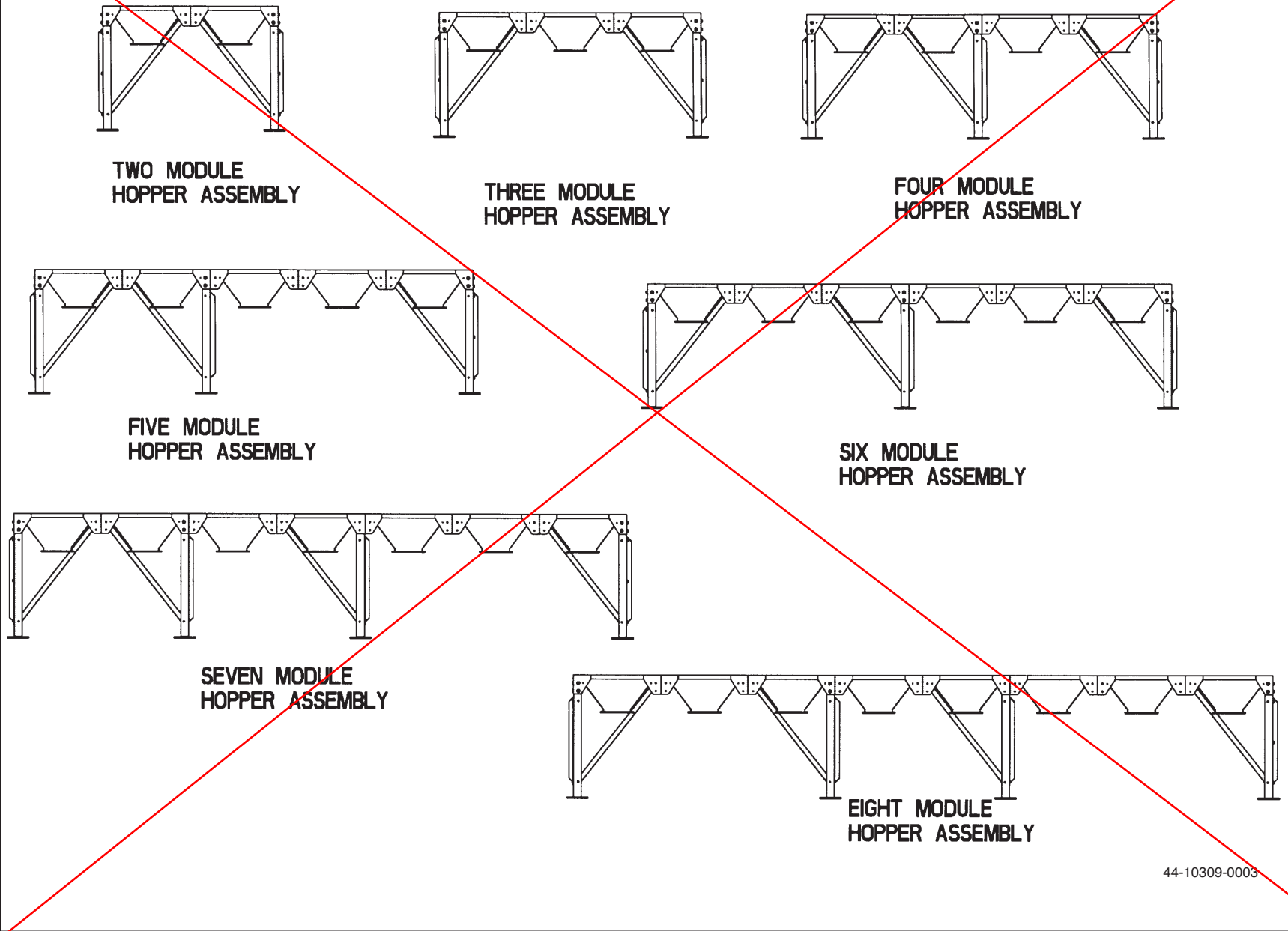
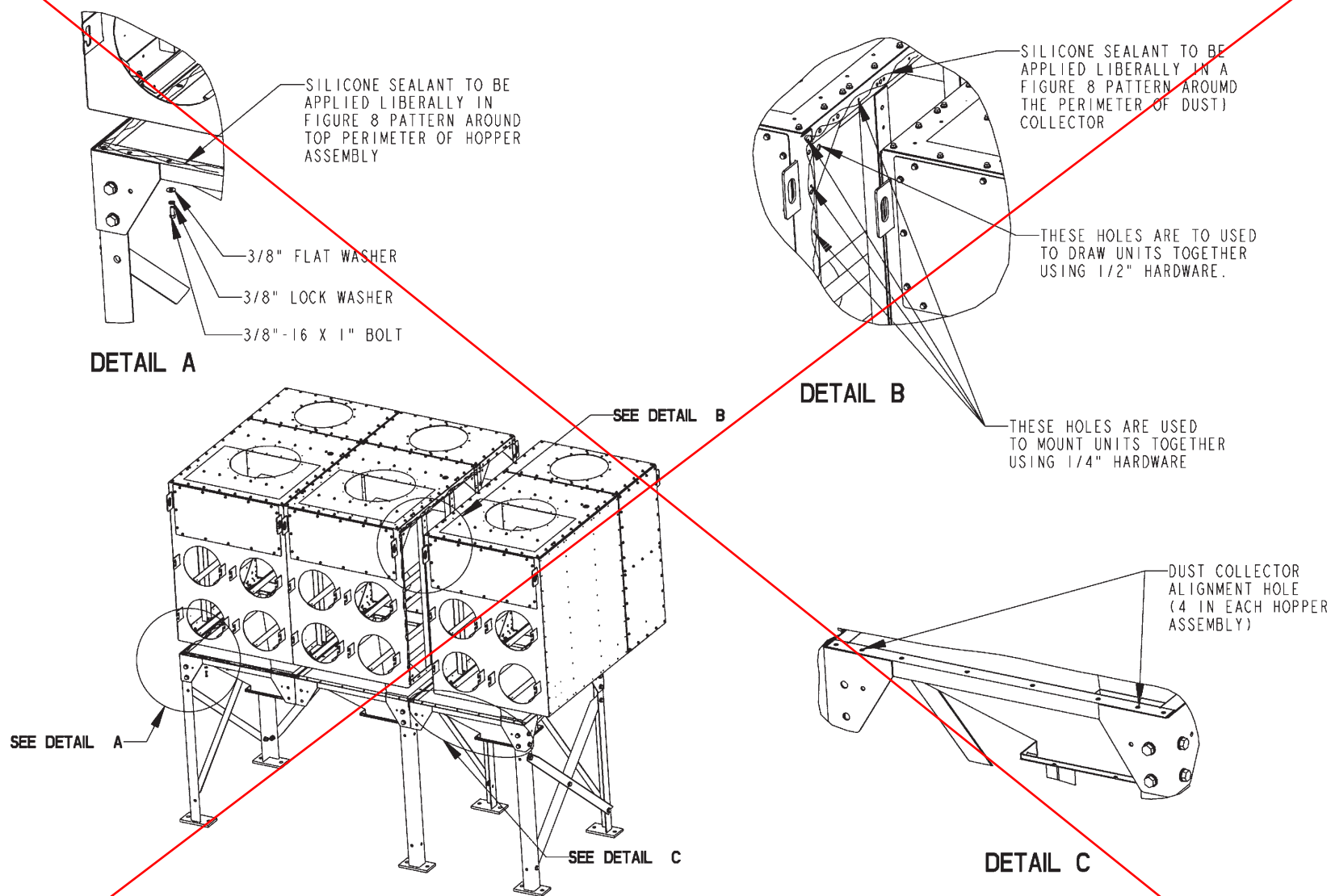


FIGURE 6  
Multiple Hopper, SFC



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**FIGURE 7**  
**Multiple Modules, SFC**

Disconnect lifting slings and spreader bars used for installation.

Apply sealant to the next hoppers that will receive a filter module (refer to Figure 7). Apply sealant to the side bolting flange of the next filter module to be installed using the “figure 8” pattern (refer to Figure 7, Detail B). Place this module on its hopper. Use the hardware provided (refer to Figure 7, Detail B).

Place this module on its hopper. Use the hardware provided (refer to Figure 7, Detail B) and bolt the module sections together. Bolt the filter module to the hopper (refer to Figure 7, Detail A). Securely tighten all hardware at the filter module and hopper. Recheck leg assembly sway braces to ensure they are tight. Install fasteners (bolt, flat washer, lock-washer, nut) to all four pry locations..

Disconnect lifting slings and spreader bars used for installation.

Repeat this process until all the module sections are in place, securely fastened and anchored to the foundation. Recheck all hardware connections to make certain they are securely tightened. Remove lift slings and spreader bars and clear all tools from the work area.

**NOTE:** Make certain all bolts (including the anchor bolts) are properly tightened before proceeding with the remainder of the installation.

Install all cartridge filters removed at the beginning of the installation process and install the filter access doors (refer to Section 5.1).

Refer to UAS sales order to verify the control configuration purchased with your unit and whether additional items are required to control and operate your system.

### 3.4.1 MOUNTING THE CONTROLS

Mount the VFD or combination starter panel for the fan motor in a convenient location. It is recommended that these controls be mounted on a wall or pedestal in an area subject to minimal vibration and electrical noise. Mounting hardware is provided by the customer or the contractor. If the panel includes the DPM or the DPC gauge and UAS timer control board, then the location of the panel must within close proximity of the dust collection unit as shown in Figure 8. For additional setup and installation information refer to the VFD and/or DPM/DPC Owner's Manuals provided.

## CAUTION

Avoid mounting the panel on the collector due to vibration generated from blower assembly and the pulsing system.

For all pulse control panels, connect the black plastic pressure tubing (25' [7.5 meters] provided by UAS) to the panel fittings and the SFC unit. Connect the dirty air plenum of the SFC to the high pressure port (dirty air) on the panel as shown in Figure 8. Connect the clean air plenum of the SFC to the low pressure port (clean air) on the panel.

## 3.4 ELECTRICAL INSTALLATION

### ! DANGER

#### ELECTRICAL SHOCK HAZARD

All electrical work should be performed by a qualified electrician in accordance with local electrical codes. Disconnect electrical power before installing or servicing any electrical component.

## GENERAL

Several types of standard electrical components can be installed to control and monitor your dust collector. A VFD or a motor starter circuit (combination starter panel) is required to safely start and stop the system. A properly sized circuit breaker or fused disconnect is also required to safely work on and service the electrical system. In addition, a 115/1/60 (2 amp) control circuit is required for the pulse control panel. Some or all of the above items may be included in the controls package you purchased from UAS. Any one of the following control combinations can be used:

- Motor starter with Digital Pulse Monitor (DPM) for continuous pulse cleaning.
- Motor starter with Digital Pulse Control (DPC) for on-demand pulse cleaning.
- VFD with DPM for continuous pulse cleaning.
- VFD with DPC for on-demand pulse cleaning.

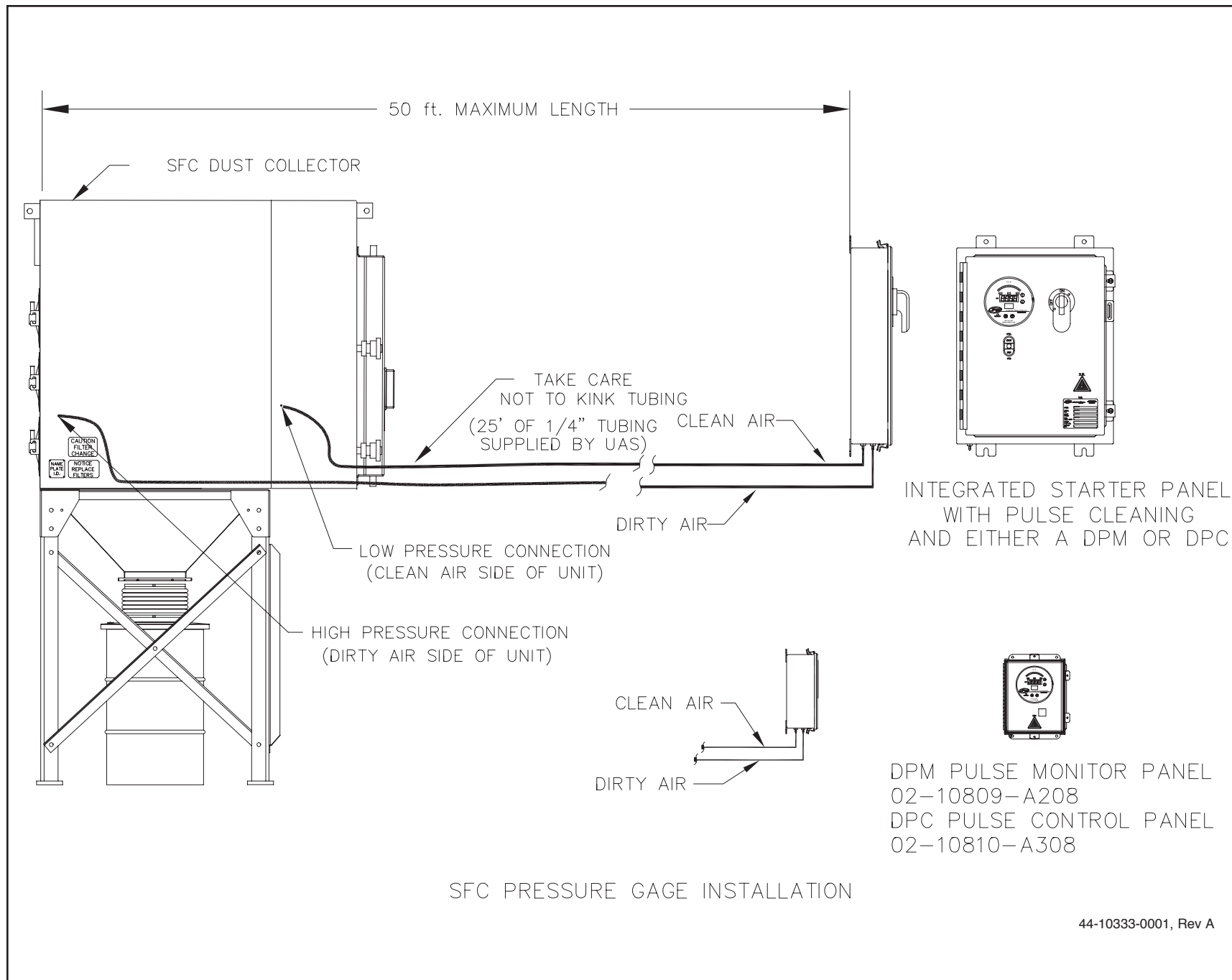
### 3.4.2 SOLENOID VALVE ENCLOSURE WIRING

The solenoid valves at the dust collector must be wired correctly to the pulse control panel. Refer to Figure 9 when making connections from the pulse control panel to the solenoid valve enclosure(s).

**Example:** Figure 9 shows the SFC having ten valve locations per module. This means when the system pulses, “1” is the first pulse in the sequence, “2” is the second, “3” is the third, etc.

When multiple dust collector modules are installed, daisy chain the wiring so that each solenoid valve with the same module location will pulse at the same time. This means all #1 solenoid valves are connected together and wired to pulse control panel “OUT 1,” #2 solenoid valves are connected together and wired to pulse control panel “OUT 2,” etc. Refer to Figure 9 for the SFC dust collector solenoid valve wiring information. When cleaning, the pulse valves sequence left to right, top to bottom.

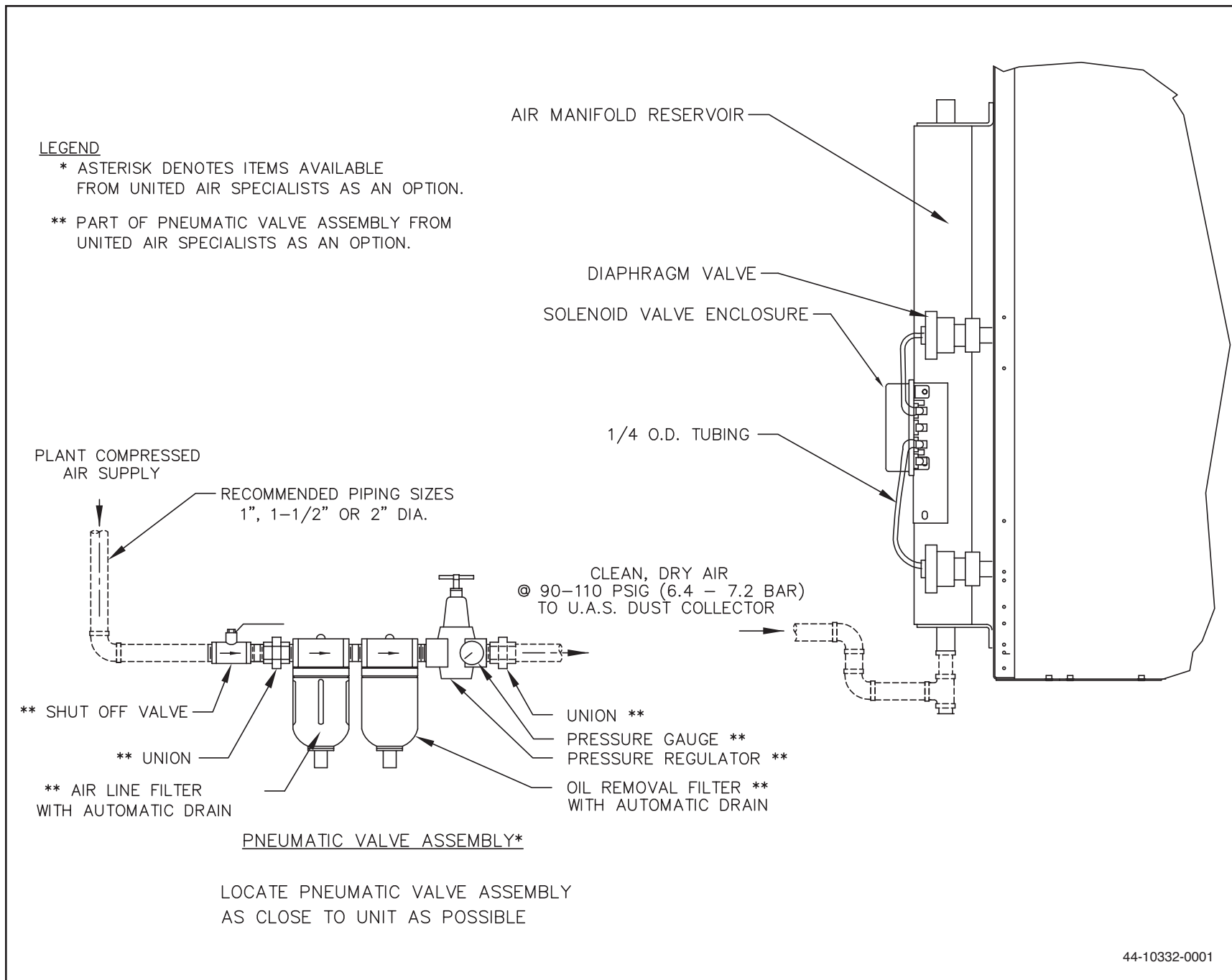
Unless specified on the UAS sales order, the customer will supply interconnecting material (conduit, wiring, etc.) from the pulse control panel to the SFC.



**FIGURE 8**  
**SFC Pressure Gauge Installation**







**FIGURE 10**  
**Pneumatic Valve Assembly**



### 3.4.3 HEATER WIRING

In cold or damp environments, the heater serves to prevent the electric solenoid valves from freezing due to cold temperatures or condensation. If optional solenoid valve heater is purchased, each 4 solenoid valve enclosures will contain a 70-watt cartridge heater, 6, 8 and 10 solenoid valve enclosures will contain a 120-watt cartridge heater internally prewired to a thermostat.

The customer must provide a 100-130VAC, 50/60Hz, 1 amp power to the heater circuit for each module. The power must be available to the module solenoid valve enclosure(s) at all times (even when the blower is shut down) to ensure temperature regulation inside each solenoid valve enclosure is continual. When multiple module solenoid valve enclosures with heaters are installed, daisy chain the wiring so that each heater will have 100/115VAC, 50/60 Hz at all times. Make certain enough current is available to supply all heaters.

**Example:** If three solenoid valve enclosures are supplied with cartridge heaters, make certain the voltage supply can deliver 3 amps (1amp per heater).

### 3.5 COMPRESSED AIR CONNECTION

#### CAUTION

Do not allow water and/or oil from the compressed air system into the compressed air manifold reservoir. To ensure a clean, dry air supply, especially when the unit is installed outdoors, a water filter with automatic drain and a coalescing filter should be installed (refer to Figure 10).

Clean, dry, 90-110 PSIG (6.2-7.6 BAR) compressed air is required for the pulse cleaning system to function properly. Compressed air consumption is noted on the UAS sales drawing. A shut-off valve, pressure regulator and pressure gauge should be installed close to the SFC unit. UAS recommends dedicated oil and water removal filters be used to ensure clean, dry air is delivered to the pulse system. Contact your local SFC representative for information about UAS' Pneumatic Valve Assembly. Refer to Figure 10 for recommended compressed air piping and Table 1 below for proper compressed air line sizing.

**NOTE:** Using Table 1, select the proper diameter compressed air line pipe to supply your dust collector. The final connection size is a female 1" NPT fitting on each module.

**Table 1**

Pipe Diameter	Number of Filter Section Modules	or	Distance of Supply Air Piping Run From Main Compressor Line
1 inch (25mm)	1-3		50 feet (15 meters)
1-1/2 inch (38mm)	3-5		100 feet (31 meters)
2 inch (51mm)	+5		+100 feet (+31 meters)

**NOTE:** Purge the compressed air line to remove any debris prior to making the final connection to the SFC compressed air manifold(s). Apply pipe fitting sealant on all compressed air supply pipe fittings and connections.

### 3.6 ASSEMBLY OF OPTIONAL EQUIPMENT

#### 3.6.1 BLOWER PACKAGE INSTALLATION

#### ! DANGER

##### TIP OVER HAZARD

Anchor dust collector to concrete pad prior to installing blower assembly. Make certain all hardware is properly tightened.

If a top-mount blower package was ordered, read the manufacturer's *Installation and Operation Manual* completely before installing the blower. The blower *Installation and Operation Manual* is attached to the fan package. Perform all pre-installation checks prior to installing the blower.

#### ! DANGER

##### TIP OVER HAZARD

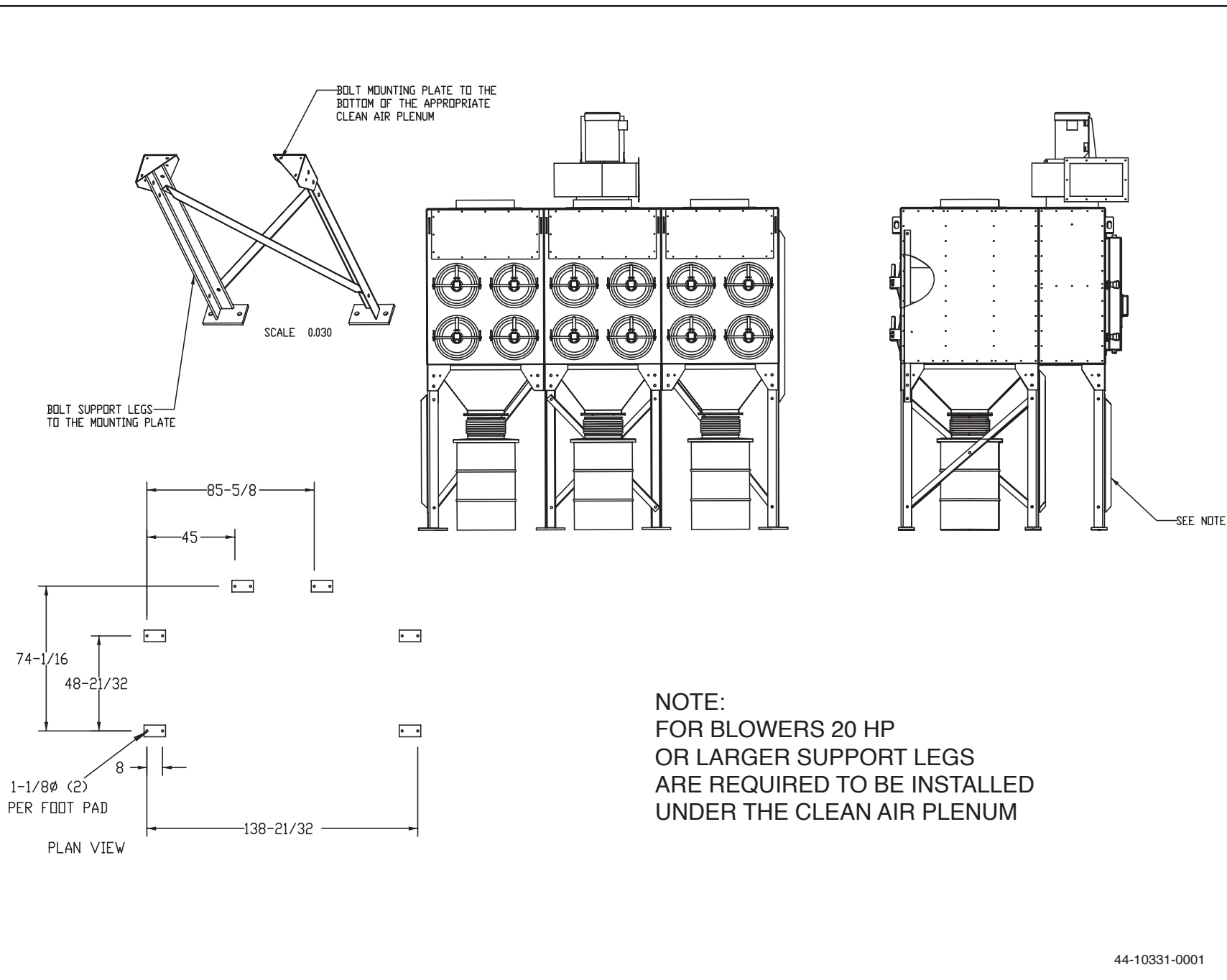
If blower package has a 20 HP (15 kW) motor or larger, ensure the blower support legs are installed beneath the clean air plenum of the module to which the blower will be mounted.

For top-mount blower packages of 20 HP (15 kW) or larger, an additional set of support legs is provided. The additional support legs must be mounted under the filter module supporting the blower package (refer to Figure 11). Bolt the mounting plate to the bottom of the appropriate clean air plenum with the hardware provided. Bolt the leg assemblies to the mounting plate with the hardware provided. Secure leg assemblies to the concrete mounting pad with appropriate anchoring hardware.

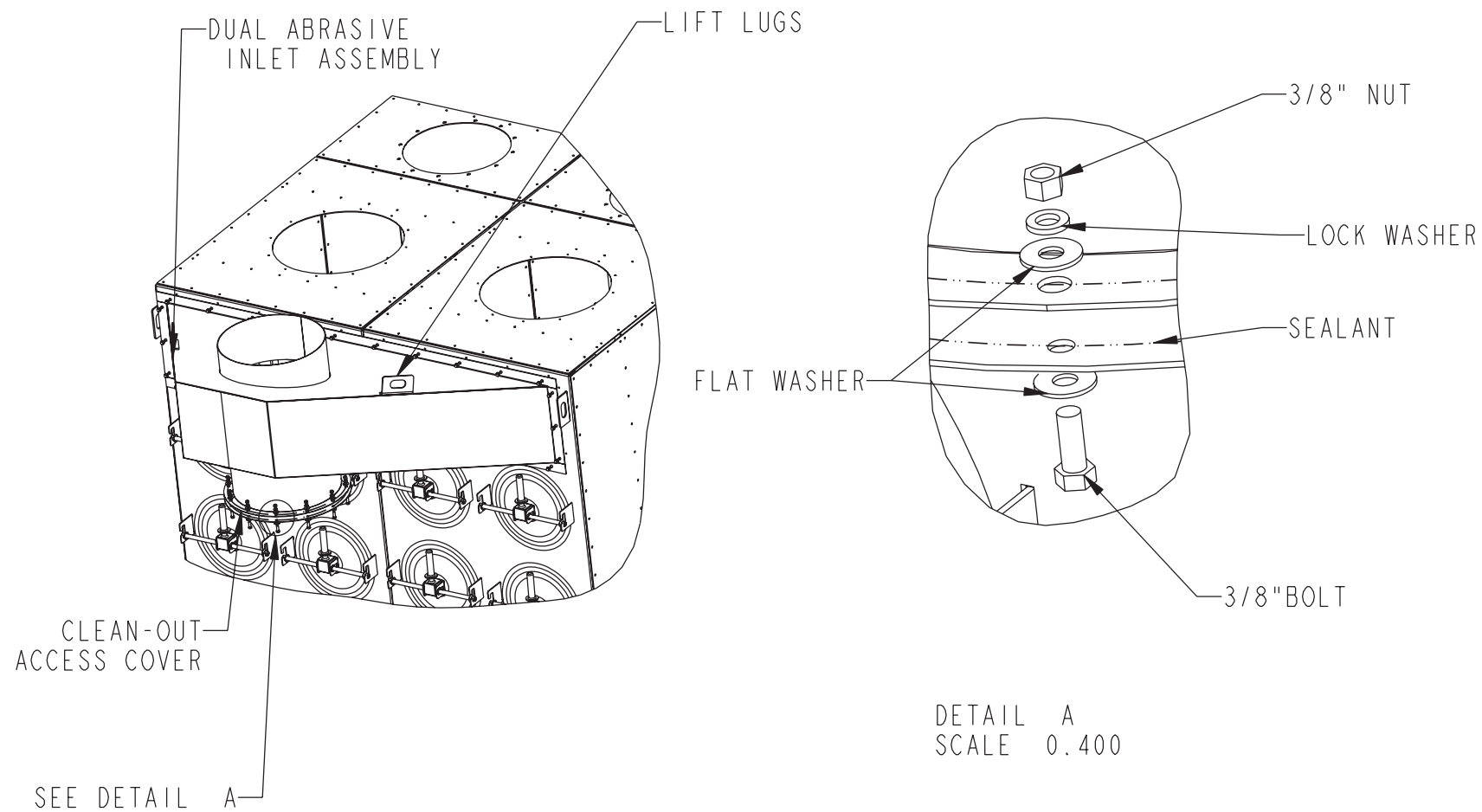
Remove the clean air plenum cover plate on top of the filter module and save the mounting hardware. Ensure ribbon gasket remains on the unit. Lift blower package using safe, suitable means and position blower base holes over filter module holes with blower discharge pointing in the desired direction. Secure with bolt/washer assemblies previously removed. Top-mount blower packages include a blower outlet damper. Install blower damper to outlet of blower assembly with hardware provided.

If the blower package is a ground-mount blower, read the manufacturer's *Installation and Operation Manual* completely before installing the blower. The blower *Installation and Operation Manual* is attached to the fan package. Perform all pre-installation checks prior to installing the blower.

Outlet ducting from the SFC unit to the blower package can be connected to either the top or bottom clean air section access panel(s). It is recommended industry practice to provide vibration isolation between the blower inlet and the dust collector outlet ducting.



**FIGURE 11**  
**Legs Support Top Mount Blower**



44-10338-0001

**FIGURE 12**  
**Abrasive Inlet Installation**

### 3.6.2 DUCT SILENCER INSTALLATION

A duct-type (in-line) silencer is designed to bolt directly to the blower outlet damper flange. Make certain there is adequate room for the silencer in the discharge direction. Provide at least 24" (61 cm) of unobstructed space at the end of the silencer discharge. The air discharge should be directed into an open area, free of obstructions and with consideration for personnel safety.

#### **⚠ WARNING**

##### **CRUSH HAZARD**

The silencer will require a separate support. Do not use the blower damper or outlet flange to support the silencer. Apply silicone around the bolt holes of the connecting flanges, lift the silencer into position and secure with the hardware provided. Install permanent supports (customer-supplied) and tighten all hardware before removing the lifting device.

### 3.6.3 ROTARY AIR LOCK INSTALLATION

If a rotary air lock was ordered with the unit, the hopper discharge will have an adapter already bolted to it. Make certain the bolts connecting the adapter to the hopper discharge are securely tightened.

Remove all packing from the rotary air lock and determine its appropriate position. Keep in mind required clearances, electrical connections and maintenance. Apply sealant to the flange of the rotary air lock and to the adapter using 3/8" bolts, washers and lock washers.

#### **⚠ DANGER**

##### **ELECTRICAL SHOCK HAZARD**

Disconnect and lockout all power to the rotary air lock before servicing. All electrical connections should be made by a qualified electrician according to all applicable codes. Refer to the nameplate and/or documentation for voltage, amperage, cycle and proper wiring. Refer to rotary air lock vendor documentation attached with air lock device.

#### **⚠ WARNING**

##### **MOVING PARTS**

There are moving parts on the rotary air lock. Do not allow any object to be placed in or near the rotary air lock during operation. Verify rotary air lock rotation matches rotation arrows affixed to assembly.

### 3.6.4 ABRASIVE INLET INSTALLATION

The abrasive inlet is designed to use the front access panel(s) of the SFC Series modules as the inlet area to the unit. There are two styles available – a single or dual module abrasive inlet. Each is designed to fit over the appropriate number of front access panels to serve as a single inlet point for one or two modules (refer to Figure 12).

Remove the front access panel(s) located above the QuickSeal filter access doors. Save the hardware. The hardware will be used to attach the abrasive inlet. Remove any remaining gasket material from around the perimeter of the opening.

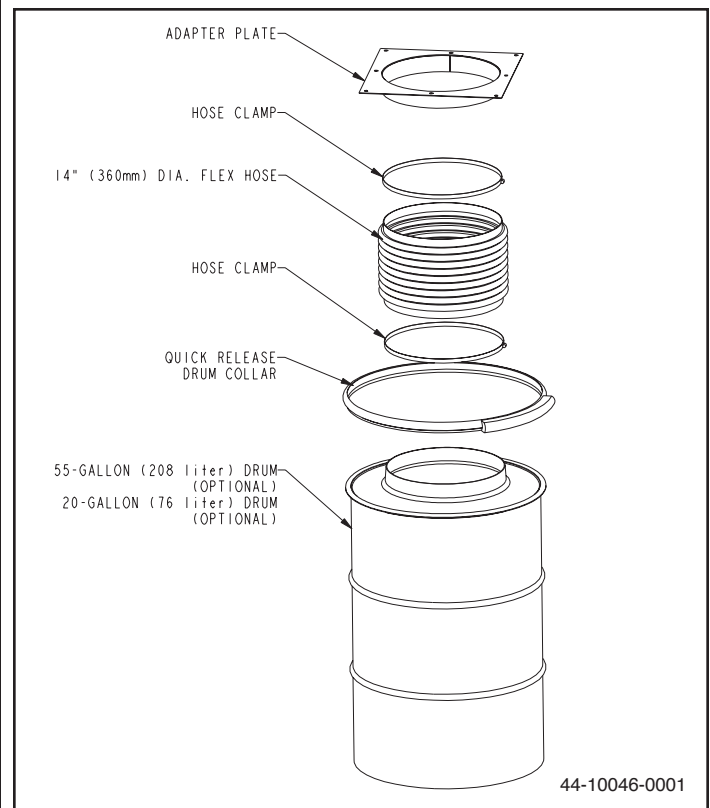
Apply a 1/4" (6 mm) bead of sealant around the perimeter of the access opening in a "figure 8" pattern around the bolt holes. Align the hole pattern on the abrasive inlet with the hole pattern on the unit and bolt together using the hardware removed earlier. Fasten the inlet ducting securely to the abrasive inlet assembly.

The bottom plate of the abrasive inlet will serve as an inspection plate. If access to the abrasive inlet is required, remove and clean out the bottom plate of the inlet prior to servicing. Do not damage the ribbon of gasket and reuse after cleaning the gasket surfaces.

### 3.6.5 DRUM LID INSTALLATION

The drum lid package is an optional accessory for the SFC Series dust collectors. Refer to Figure 13.

Remove the drum lid package from its shipping carton. Place the drum lid on the 55-gallon (208 liter) drum or the 20-gallon (76 liter) drum. Slide the 14" (360mm) diameter hose over the drum lid and secure with hose clamp. Position the drum assembly under the unit, slide the hose up onto the 14" adapter collar on the hopper and secure it with a clamp.



**FIGURE 13**  
Drum Lid Installation

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If a drum lid quick release clamp was ordered, use its clamping mechanism to secure the drum lid and drum. To install the clamp: Before placing the drum lid into place, open the clamp and slide it around the drum. Once the clamp is around the drum, install the drum lid on top of the drum. After the drum lid is in place, slide the clamp up and around the lip of the drum lid and drum. Once the clamp is around the lip of the drum, pull the clamp close to secure the drum lid.

If a slide gate was ordered, it was factory installed on the hopper. Open the slide gate. Repeat for multiple drum lid connections.

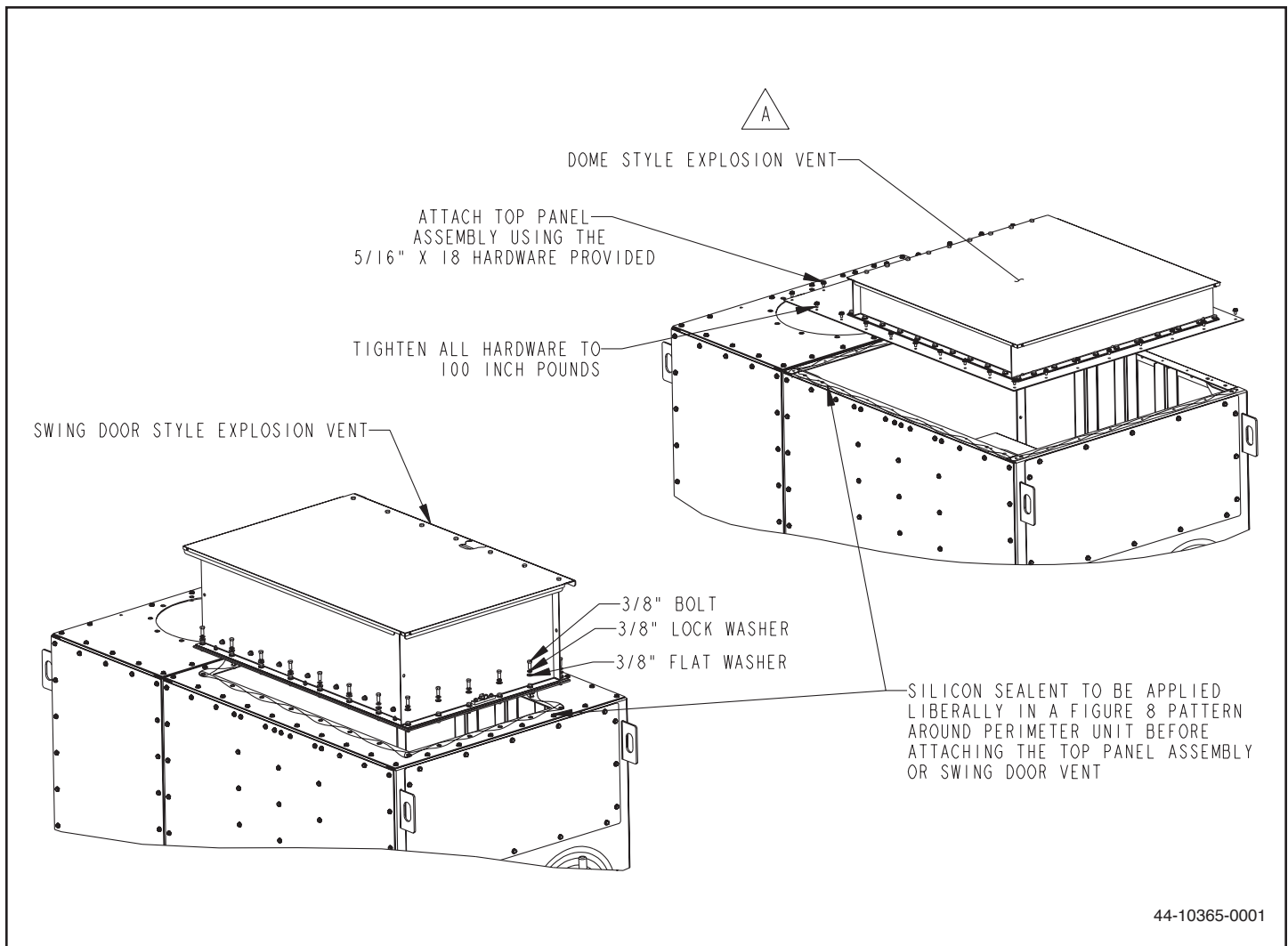
**NOTE:** The hopper(s) is not designed for dust storage. The slide gate should remain open during normal operation.

### 3.6.6 INLET COVER AND BLANK COVER PLATE INSTALLATION

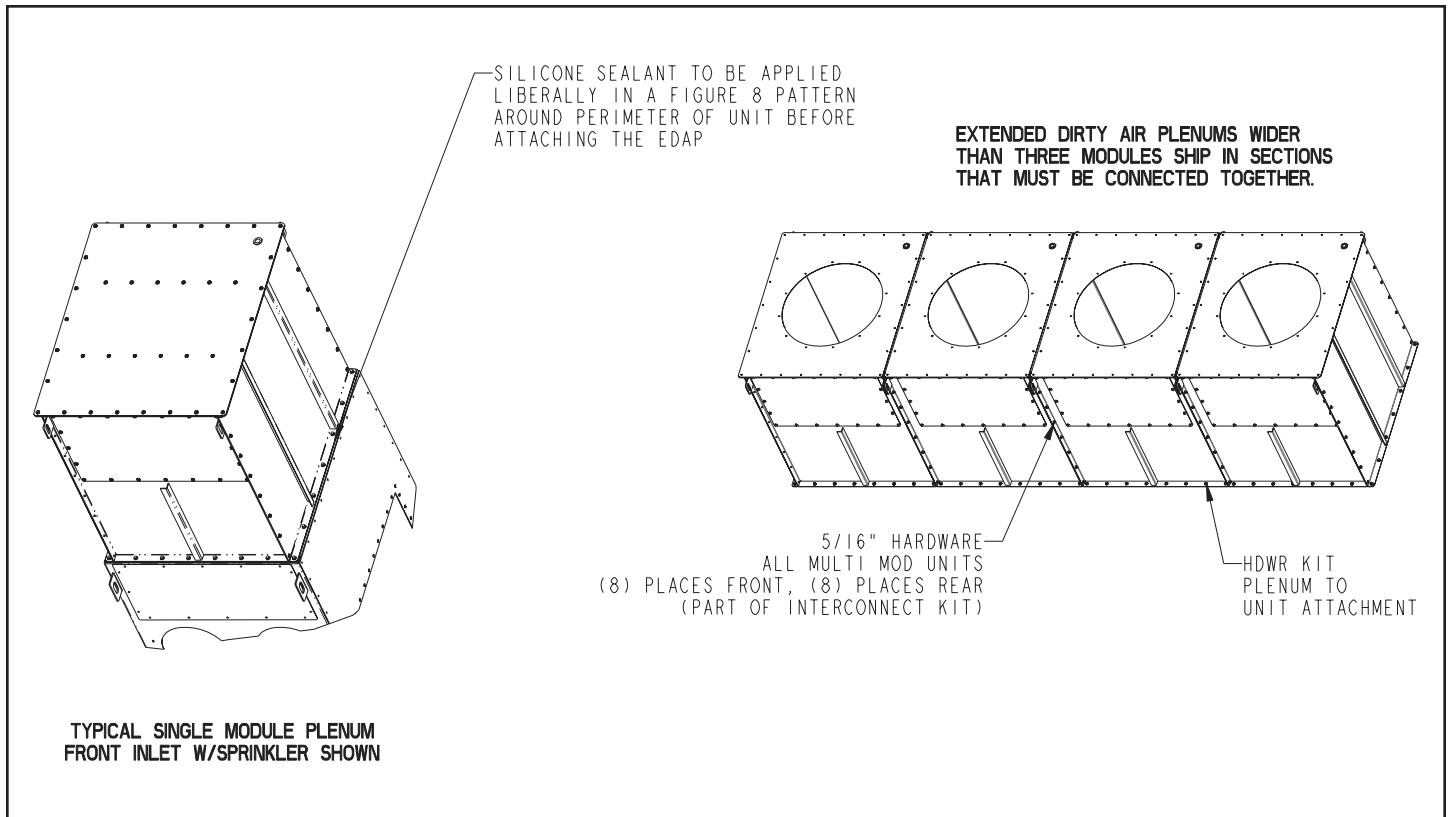
Inlet collar and blank cover plates bolt directly to the SFC unit. Inlet and outlet collar assemblies are specified with initial order; the dust collector is supplied with all blank cover plates.

### 3.6.7 REMOTE BLOWER START/STOP ASSEMBLY

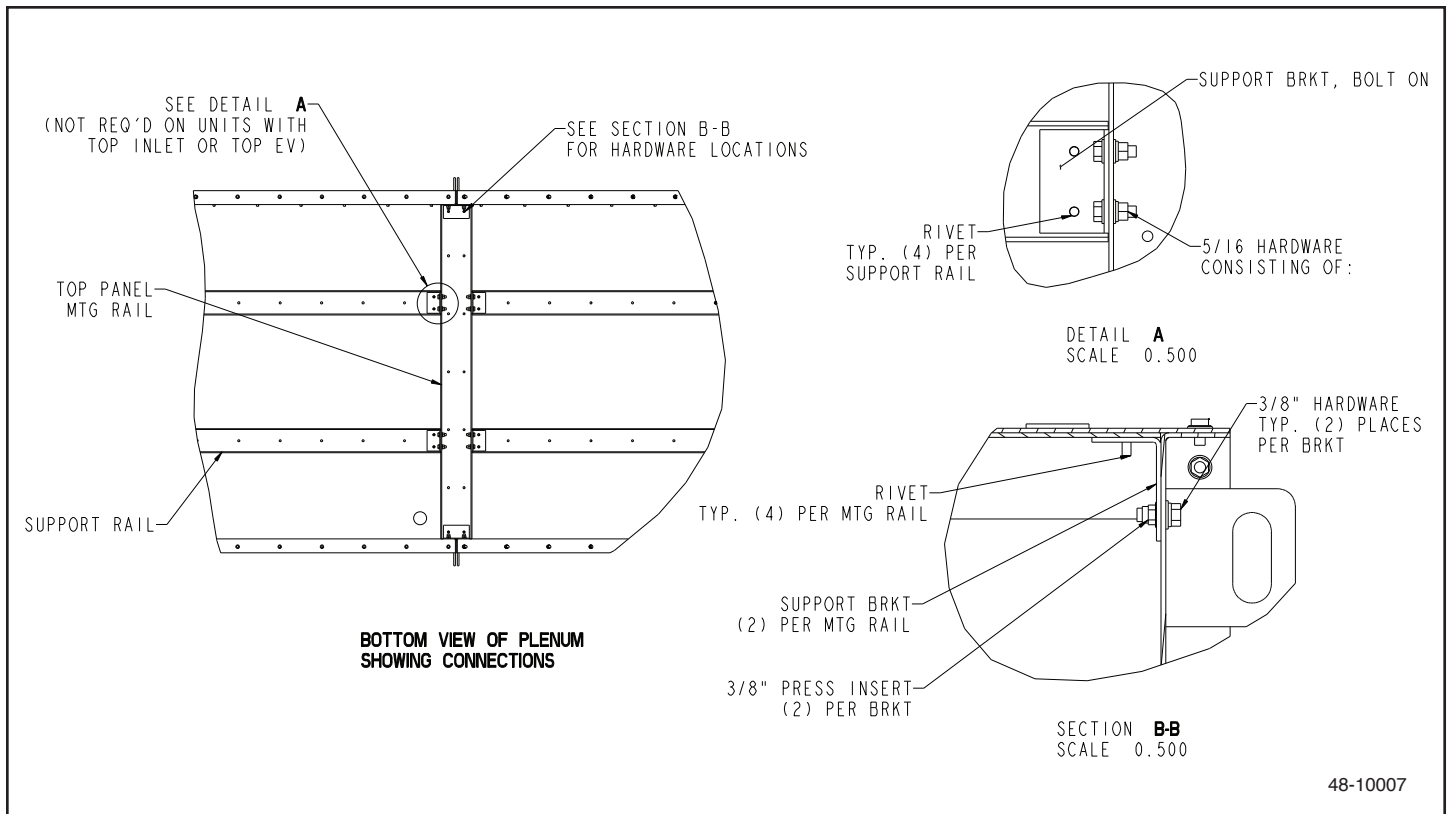
A remote blower start/stop push button station is available for field installation with SFC systems supplied with a UAS combination magnetic motor/blower starter panel. The customer is required to supply interconnecting field wiring and mounting hardware for remote blower start/stop push button station installation. Refer to the DPM/DPC *Installation and Operation Manual*.



**FIGURE 14**  
SFC Explosion Vent Installation (Top Mount)



**FIGURE 15**  
**EDAP Installation**



**FIGURE 16**  
**EDAP Interconnection**



### 3.6.8 EXPLOSION VENT INSTALLATION

#### 3.6.8.1 INTRODUCTION

Your United Air Specialists, Inc. Dust-Hog® supplied with an explosion vent is designed to minimize structural damage in the event of an explosion. It does not prevent explosions!

The responsible user should:

1. Take every possible precaution to prevent a fire or explosion from occurring
2. Consult with their insurance carrier or local authorities regarding the hazardous nature of dust produced by them.
3. Consult and comply with national and local codes or bulletins when determining location and operation of the dust collector.
4. Do not exceed negative operating pressure of the unit.
5. Do not exceed operating temperature of the dust collector (not to exceed 180°F (82°C)).

#### 3.6.8.2 OPERATING & PRECAUTIONS

1. Install unit with the explosion vent directed away from occupied areas.
2. When the explosion vent is properly installed, the rating tag and caution stickers should be in plain sight for all to see. If the explosion vent is installed incorrectly, damage could occur to the explosion vent and to the operator or plant equipment.
3. Ductwork added to the explosion vent flange may create a secondary hazard. User must comply with NFPA standard 68, and/or other codes that apply.
4. Do not place hands or any other objects in vent opening. Serious injury or damage to plant equipment could occur.
5. If any leakage occurs, shut down unit and contact UAS immediately.
6. Never inspect explosion vent(s) with unit running.
7. Only use explosion vent supplied by United Air Specialists, Inc.
8. Any vent installed, which has been provided by someone other than UAS will void all warranties on the dust-collector.

### DANGER

In case of explosion, contact UAS immediately. Do not operate or rearm the collector with another explosion vent without contacting United Air Specialists Inc. first. Serious injury could occur.

#### 3.6.8.3 UNIT SET-UP

The normal shipping routine for an assembled SFC unit is with an enclosed box truck. This type of truck will not be able to transport an assembled 4-high unit due to height restrictions within the vehicle. When shipping this unit, it will be necessary to ship the top panel and explosion vent separately. This will require the customer to assemble this to the unit on site. Refer to Figure 14 for assembly details.

#### 3.6.9 EXTENDED DIRTY AIR PLENUM (EDAP) FOR 5 HIGH SFC UNIT

The normal shipping routine for an assembled SFC unit is with an enclosed box truck. This type of truck will not be able to transport an assembled 5-high unit due to height restrictions within the vehicle. When shipping this unit, it will be necessary to ship the EDAP separately. This will require the customer to assemble this to the unit on site. Refer to Figures 15 & 16 for assembly details.

### 4. OPERATION

### DANGER

Shut off unit disconnect and lock out all electrical power to the dust collector prior to performing service work.

### CAUTION

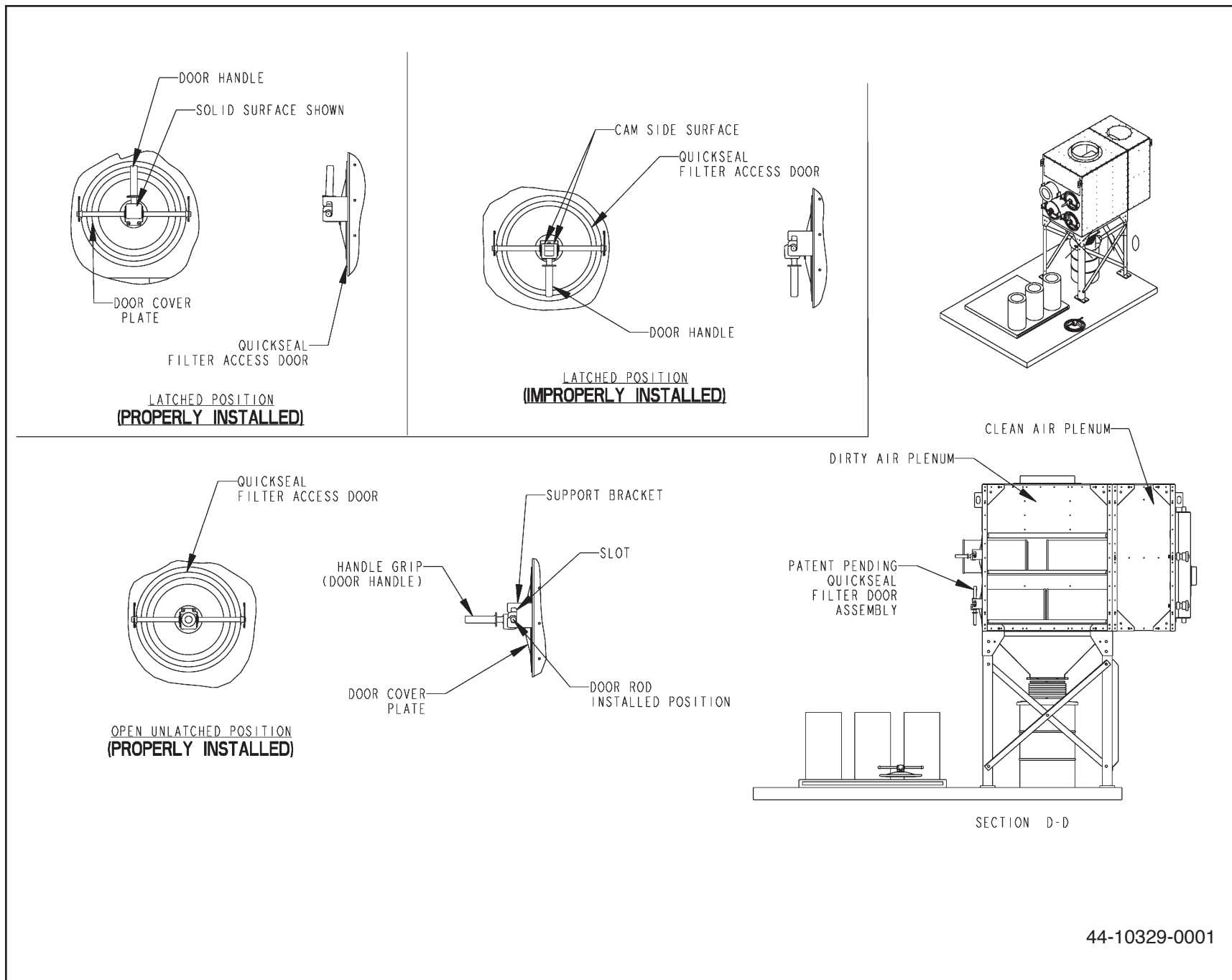
Prior to unit start-up, all installation set-up instructions must be completed as specified by this manual. Refer to Section 3.

#### 4.1 START-UP

Inspect the installation area and make certain no tools, parts, etc., have been left on or inside the SFC unit. Check blower discharge to make certain it is free from all debris.

Start motor/blower and check for proper rotation. A rotation arrow is located on the blower housing. All top-mount blower assemblies rotate in a clockwise rotation as viewed from the driven end (motor end with motor cooling fan). If blower is rotating in the opposite direction, place disconnect switch in the OFF position to the motor starter. For 3-phase blowers, interchange any two power wires to the motor at the load side of the motor starter contactor. For single-phase power, refer to motor nameplate for which two wires to interchange at motor junction box. Engage starter disconnect switch, start blower and recheck rotation.

**NOTE:** Proper blower rotation is required to move the designed amount of air. A blower rotating in the incorrect direction will only move approximately 40% of design airflow.



44-10329-0001

**FIGURE 17**  
**SFC Series Door/Filter Installation**



## CAUTION

The blower assembly provided by UAS includes an outlet damper. If the blower assembly was purchased separately, ensure an outlet damper is included. Close the blower discharge damper to the 50% open position and tighten in place. If a volume control damper is provided in another part of the dust collection system, adjust second damper to the 50% open position and tighten in place.

**NOTE:** It is important that the air volume of the dust collection system is at design conditions at system start-up. There is a minimal pressure differential across new cartridge filters. If the volume control damper is not correctly adjusted, the air volume will be above design conditions for airflow and will affect cartridge filter life and may kick-out starter overloads.

## CAUTION

Verify dust collector system airflow is adjusted to design conditions with a new, clean filter using the volume control dampers installed in the system. Failure to properly adjust system airflow will affect cartridge filter life.

The air volume should be adjusted based on the performance of the entire system. The air volume control damper must be adjusted to the system design airflow. Closing the volume control damper decreases system airflow. Opening the volume control damper increases system airflow.

Turn on the compressed air supply to the dust collector air manifold reservoir. Adjust the pressure regulator until the gauge reads 90-110 PSIG (6.2-7.6 BAR).

## 4.2 CHECKLIST

Check the discharge of the blower assembly. Initially, some dust may discharge from the blower assembly as the filters are being seasoned. This may last several minutes after which the discharge air should remain visibly clean.

Measure the total airflow and static pressure at the inlet to the SFC unit. Adjust the blower damper for the desired airflow. Check to ensure that adequate air is being drawn into each of the collection points of the system. Adjust the individual dampers for each operation to balance the system airflow. Recheck the total system airflow and adjust the blower damper to desired system airflow. This procedure may need to be repeated several times until the entire system is within system design airflow specifications.

Check the differential pressure reading across the dust collector clean-to-dirty air sections. A normal differential pressure drop reading is between 1"-5" w.g. (25-127 mmAq). At start-up, this reading is generally in the 1"-3" w.g. (25-76 mmAq) range. Please list the reading here for future reference.

Initial dust collector differential pressure reading across filters is \_\_\_\_\_" w.g. or \_\_\_\_\_ (mmAq) on \_\_\_\_\_ (date).

## 4.3 CHECKING THE PULSE CLEANING SYSTEM

Confirm the type of pulse cleaning controller delivered with your system. Your system was delivered with one of the following:

- DPM Pulse Control Panel
- DPC Pulse Monitor Panel

Check the pulse cleaning system for proper operation. The compressed air pressure should be between 90-110 PSIG (6.2-7.6 BAR). UAS' pulse control panels are factory set to pulse every 10 seconds. Refer to the DPM/DPC *Installation and Operation Manual* specified with the dust collector to change these initial settings. Check to ensure the pulse (diaphragm) valves are "firing" at approximately 10-second intervals and deliver a crisp sounding pulse to each filter. The valves should not deliver a weak sound. If an extended "hiss" is heard afterwards, the pulse is too long, which does not assist in cleaning, and wastes compressed air.

- If your system is supplied with a DPM Pulse Monitor Panel, place the "Continuous Clean/PS" switch on the timerboard to the "Continuous Clean" position. Or if the system is supplied with DPC Pulse Control, place the "Continuous Clean/PS" switch on the timerboard to PS position. The MOT AUX terminals at the timerboard should be field wired for the pulsing to become active. To activate, energize the motor starter to close the isolated auxiliary contact wired to the timerboard MOT AUX terminals. Verify consistent firing of each solenoid valve exhaust port.

**NOTE:** It is important that the compressed air pressure is in the 90-110 PSIG range (6.2-7.6 BAR) immediately prior to pulse. If the delivery capability of your compressed air source cannot return the manifold pressure to above 90 PSIG during the "Pulse Delay" (factory set at 10 sec.) interval, adjust the pulse delay at the timerboard and monitor the pressure. A longer interval will raise the operating pressure, which is the pulse delay. (Adjust from position 2 to position 3 on the timer board.) Allow sufficient time for the system to stabilize after each adjustment before making any further adjustment. Adjust until the desired manifold pressure is reached.

### 4.3.1 DIGITAL PULSE MONITOR (DPM) PANEL

The DPM is always set to "Continuous Clean" pulse mode, which means pulse cleaning is operating continuously when the system is online. Refer to the DPM/DPC *Installation and Operation Manual* for additional information.

### 4.3.2 DIGITAL PULSE CONTROL (DPC) PANEL

The DPC Pulse Control Panel is set for "Pressure Switch" or "PS" pulse mode. With the DPC control, the desired pressure can be maintained by adjusting the high and low set-points on the panel. The factory setting is 3.0 (high set-point) and 2.5 (low set-point). This allows a 0.5" "deadband" and the pulse system will maintain the desired pressure. The high and low set-points on the DPC can be adjusted as the filters season and continuous pulsing occurs. Adjust upward in 0.5" increments until pulsing stops. Continue adjustments, when required, until the high set-point reaches 5". No further adjustments should be made over 5" w.g.

## 5. SERVICE

### DANGER

#### Before servicing dust collector:

- Wear appropriate protective clothing when servicing dust collector.
- Disconnect and lockout electrical power to the unit and control panel.
- Close off and slowly bleed the compressed air supply from the air manifold reservoir. Air manifold reservoir pressure should be reduced to 0 PSIG (0 BAR).
- Collected dust may be hazardous. Consult proper authorities for handling and disposal.
- Collected dust may be a potential fire hazard. Welding, grinding or operations involving open flames should not be performed without fire protection measures in place. Refer to Section 1 of this manual for additional precautions.
- Disposal of collected dust must be according to federal, state and local regulations and all appropriate authorities.

### 5.1 CARTRIDGE FILTER REMOVAL AND REPLACEMENT

ProTura® Nanofiber filters are the only replacement filters which provide the highest level of performance expected from the SFC Dust Collector.

Replacement cartridge filters should be ordered when the differential pressure is consistently above 5" w.g. (127 mmAq) or system airflow is inadequate and won't significantly recover with off-line (no fan pulse) cleaning. To order filters, contact UAS at 888-515-8800.

#### TO REPLACE CARTRIDGE FILTERS

1. Read and follow caution instructions in box above before servicing your unit. Start with the top row of QuickSeal doors. (Figure 17)

2. Tap the metal surface of each filter access door to remove collected particles from the inner door gasket. Pull the QuickSeal door handle away from the dust collector until the handle makes a 90° angle with the door cover. The filter access door is now in an unlatched position. Lift the QuickSeal filter access door upward until the door rods clear the side support brackets. Pull the door away from the dust collector. Tilt the door cover away from the dust collector once free from the support brackets to trap any dust on the inside of the filter access door. Dispose of dust into a suitable container. Place filter access door in a safe place.
3. Move filter from side to side to break the gasket seal between filter-to-filter-to-tubesheet locations. Rotate the filter 180° to allow the dust on top of the cartridge filter to fall into the dust collector hopper.
4. Slide the filters out of the dust collector and transfer to a suitable disposal container. Repeat this procedure for the remaining filters.
5. Inspect the tubesheet and make certain the gasket sealing area is free of dust to ensure proper sealing of the new filter. Make certain the area is dry after the cleaning process is complete.
6. Install new ProTura® Nanofiber cartridges into each filter compartment, gasket end first. Clean the filter door gaskets and align with door rod support brackets on the dust collector. Door handle must be placed at a 90° angle to filter access door prior to placing the door cover plate support rod in the support brackets (refer to Figure 17). The flat surface of the door handle should be facing downward. To close the filter access door, push the door handle upward, toward the unit.

### WARNING

The QuickSeal filter access door handle must be in a perpendicular orientation to door surface prior to being closed. A flat solid section of door handle will be visible when door assembly is in the properly closed position. Refer to Figure 17.

If cam surface of the door handle is visible, QuickSeal filter door assembly has been improperly installed.

7. The SFC dust collector is now ready to be placed back in service. Reconnect electrical power and air supply. Please follow the initial start-up checklist to ensure proper unit performance.

### 5.2 DUST REMOVAL

### WARNING

Do not let the dust storage drum overfill. This can cause poor dust collector performance and require extensive clean-up due to the overflow of dust when removing the collection container(s).

Turn off the dust collector (power to fan system and compressed air to cleaning system) and empty the dust storage drum as necessary to prevent dust from accumulating in the hopper(s). Empty the dust storage drum(s) when two-thirds full. If the hopper has a slide gate, close the slide gate before servicing the dust storage drum(s). The dust collector fan and compressed air cleaning systems do not have to be turned off if the hopper slide gate is closed prior to servicing storage drums. Remember to open the slide gate when the dust storage drum is replaced.

### 5.3 SERVICING THE COMPRESSED AIR COMPONENTS

#### WARNING

Shut off and slowly release the pressure in the compressed air piping or the SFC compressed air manifold reservoir prior to servicing this equipment.

1. The compressed air system should be periodically checked to ensure clean, dry, oil-free air is delivered to the SFC dust collector. Check the compressed air components and service as recommended by the manufacturer.
2. Periodically check the dust collector air manifold reservoir(s) for contaminants and drain any condensed liquid from manifold reservoirs.
3. With the compressed air supply turned on, check the diaphragm valves, electronic solenoid valves and interconnecting tubing between both devices for any air leakage. Replace any components that are defective or worn.

### 5.4 SERVICING THE DIRECT DRIVE BLOWER AND MOTOR SYSTEM

#### DANGER

#### ELECTRIC SHOCK HAZARD

All electrical work should be performed by a qualified electrician in accordance with local electrical codes. Disconnect electrical power before installing or servicing any electrical component.

Refer to blower assembly *Installation and Operation Manual* provided with blower assembly for servicing requirements.

### 5.5 SERVICING CARTRIDGE MEDIA

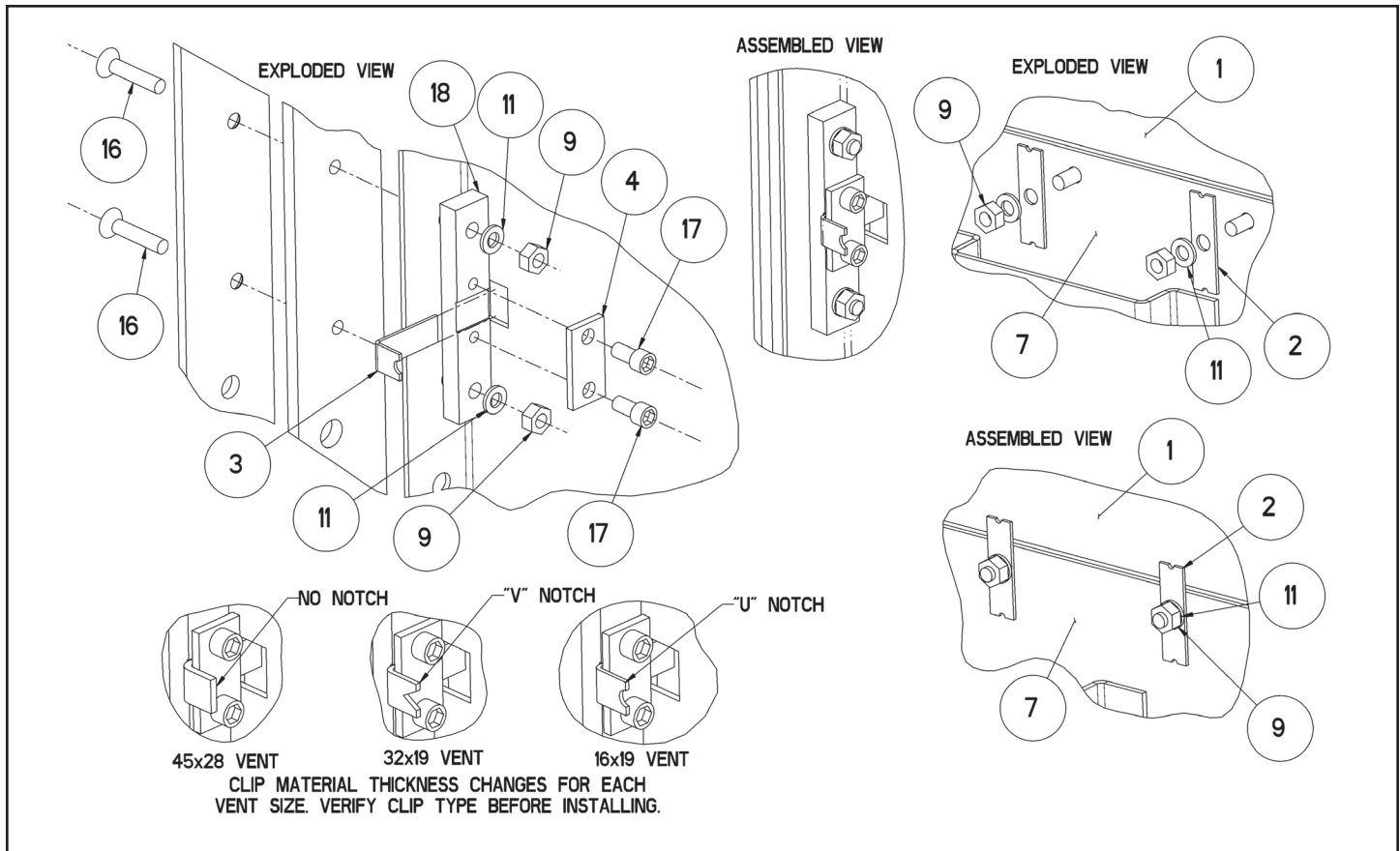
Before replacing cartridges, try down time (fan off) to see if system recovers. If upon restart, collector S.P. is 2-1/2" (63 mmAq) to 3" (76 mmAq) and it takes several days to work back up to over 5" (127 mmAq), there is still "life" left in the cartridges. If upon restart, 4 hours later S.P. is back over 5" (127 mmAq), it is time to change out the cartridges.

### 5.6 SERVICING OPTIONAL RETURN AIR SAFETY FILTERS (HEPA/ASHRAE)

Periodically check the pressure drop across the return air safety filters. Replace when the differential pressure drop exceeds 2" w.g. (51 mmAq) for ASHRAE filters and 3" w.g. (76 mmAq) for HEPA filters.

CARTRIDGE FILTER	UAS PART NUMBER	GENERAL DESCRIPTION OF FILTER MEDIA
ProTura® Nanofiber	33-10089	ProTura® Nanofiber layer on cellulose
ProTura® Nanofiber-FR	33-10089-1	ProTura® Nanofiber layer on cellulose with fire retardant material treatment
ProTura® Nanofiber, Wide Pleat	33-10089-5	Half the media quantity of the ProTura® Nanofiber filter
ProTura® Nanofiber-FR, Wide Pleat	33-10089-15	Half the media quantity of the ProTura® Nanofiber-FR
Poly-Fiberglass-W	1212667	Mixture of polyester and fiberglass fibers
Spun-bond-P	1212669	Spun-bond polyester fibers
Spun-bond-T	1212671	Spun-bond polyester fibers with PTFE surface membrane

**TABLE 2**  
**Cartridge Filters**



**FIGURE 18**  
**Swing Door Vent, Parts Detail**

## 5.7 PROTURA® NANOFIBER CARTRIDGE FILTERS

The SFC product line is designed to accept ProTura® Nanofiber cartridge filters. Table 2 highlights the most common UAS cartridge filters.

UAS will custom design cartridge filters for application-specific systems. Contact the UAS office for additional information.

## 5.8 EXPLOSION VENT REPLACEMENT

### 5.8.1 DOME STYLE EXPLOSION VENT REPLACEMENT

#### ⚠ CAUTION

CUT HAZARD WEAR PROTECTIVE CLOTHING

1. In case of explosion, contact UAS immediately. Do not operate or rearm the collector with another explosion vent membrane without contacting UAS first. Serious injury could occur.

2. Verify that the system is depressurized and safe for human exposure before attempting to remove the old or burst rupture panel. While loosening the capture frame bolting, take care to avoid the sharp edges of the rupture panel as these can cause severe cuts and/or abrasions. Remove the capture frame and set aside.
3. After removal of the capture frame, remove the rupture panel. This may require bending panel sections away from the frame for frame removal. Care should be taken to avoid sharp panel edges during this activity.
4. Dispose of the removed rupture panel in accordance with applicable local and federal regulations.
5. Install the new rupture panel. Make sure all tags and danger warnings are placed on the side of the explosion vent facing out towards installer. Secure with the appropriate gasket material, bolting and previously removed capture frame.
6. Rupture panels are not bolt torque sensitive; i.e., bolt torque does not increase or decrease the rupture panel set pressure. The bolt torque used should be only that which is sufficient to create a leak-free seal.

## 5.8.2 SWING DOOR RE-ARMING INSTRUCTION

### CAUTION

**ENSURE THAT YOU HAVE THE PROPER CLIP TYPE FOR YOUR SIZE VENT. FAILURE TO USE THE CORRECT CLIPS MAY CAUSE VENT TO FUNCTION IMPROPERLY.**

In the event of an explosion or other unforeseen circumstances, it may be necessary to re-arm the explosion vent located on your Dust Collector. Parts discussed in this procedure are identified by numbers that coincide with those shown by a detail drawing and parts list.

A violent explosion may deform the doors (7) (1) which will require replacement in addition to the clip hold downs (3) and flat clip supports (4).

**Before re-arming a vent where doors are not damaged:**

1. Check the flat clip supports (4) for flatness. If only one end is bent, flip or rotate 180°, and reuse. If both ends are bent, replace. Do not flatten and reuse, as the operating characteristics of the vent will change.
2. Reorder clip hold downs (3) and replace. Do not flatten or reuse clip hold downs.
3. Check gasketing. Replace if damaged or abnormally compressed. If vent has been in operation for two years, replace gasket.
4. Loosen four socket hex cap screws (17) on door compression plate (8). Remove bent clip hold downs (3).
5. Loosen nuts (9) holding flat clip supports (2) on internal door edge (7). Check flat Clip supports (2) as directed above. Rotate 90° so flat clip support (2) is parallel with the door edge (7).
6. Pull door (1) into an almost closed position.
7. Pull door (7) against door (1) until both doors are closed and hold. Make sure that both top and bottom door edges fit under gasket.
8. Rotate flat clip support (2) 90° so that the flat side is over the edge of the door (1) in a perpendicular position. Finger tighten nuts (9).
9. Push new clip hold downs (3) into recessed area of clip support block (18) until they stop. Make sure that the forward edge of the clip hold downs (3) are over the outside edge of the door plate (5).
10. Tighten four socket hex cap screws (17).
11. Tighten nuts (9). Make sure the flat clip supports (2) remain perpendicular to the edge of the doors (7) (1).
12. Release handle. Explosion vent is now rearmed.

## 6. TROUBLESHOOTING GUIDE

Use the troubleshooting guide to correct any problems that occur with your dust collection unit. If the problem or condition continues, contact the UAS customer service office.

### ⚠ WARNING

All electrical/mechanical troubleshooting should be performed by a qualified electrician/maintenance individual familiar with UAS equipment.

Prior to troubleshooting any equipment, read the Installation and Operation Manuals for each piece of equipment to be serviced.



PROBLEM	POSSIBLE CAUSES	RECOMMENDED SOLUTIONS
Motor/blower won't start or won't stay running.	Blower rotation is running in reverse.	Reverse blower rotation (refer to Section 5.1).
	No voltage to system.	Check primary voltage to motor circuits for proper voltage on all legs.
	Improper electrical wiring.	Check and correct internal motor wiring for proper connections based on the incoming line voltage at the motor junction box. Check control voltage power (i.e. fuses, transformer, etc.).
	Starter overloads are tripped.	Check for proper motor starter overload rating against full load amps on motor nameplate. Adjust or replace overloads as required.
	Hopper discharge open to atmosphere.	Ensure drum is properly sealed against drum lid package. Ensure drum lid package is properly installed (refer to Figure 13).
	Blower damper not properly adjusted.	Check motor current draw and close volumetric control damper or silencer damper until amperage FLA is below full load rating of motor.
	Low system static pressure.	Close dampers to increase static pressure or install orifice plate in a branch duct.
Dust emissions from clean air discharge.	Filters not installed properly.	Inspect and reinstall cartridge filters (refer to Section 6), gasket end first.
	Filters are damaged.	Replace damaged filter(s) with new ProTura® Nanofiber cartridge filter(s).
	Filter access doors not installed properly.	Remove and reinstall QuickSeal filter access door assembly (refer to Figure 17 and Section 6).
Insufficient airflow.	Blower rotation is running in reverse.	Reverse blower rotation (refer to Section 5.1).
	Loose or open access.	Remove QuickSeal filter access door assembly, verify filters are properly installed (refer to Section 6.1 and Figure 17), gasket end first. Verify drum lid is installed properly (refer to Figure 13).
	Volumetric duct dampers or blower outlet damper is not positioned properly.	Adjust dampers to allow for sufficient air volume (refer to Sections 5.1 and 5.2).
	An inlet(s) obstructed.	Inspect and clean all hoods and other machine connections.
	Filters plugged.	Refer to troubleshooting procedures for continual pressure drop.

PROBLEM	POSSIBLE CAUSES	RECOMMENDED SOLUTIONS
Continual, excessive pressure drop (over 5" [127 mmAq]) on filter monitoring panel.	Compressed air supply problems.	Check incoming compressed air for proper supply at air manifold reservoir (90-110 PSIG [6.4-7.2 BAR]), pulse flow (1.7 SCF standard cubic feet [48.1 liters] per pulse) and pulse duration (100 milliseconds). Correct any problems.
	Pulse cleaning system not functioning properly.	Check incoming 110-115 VAC power to cleaning control panel. Check control panel boards for blown fuses. Check 110-115 VAC supply power circuit (transformer, primary/secondary fuses, etc.). Replace as necessary. Consult the cleaning control panel <i>Installation and Operation Manual</i> for additional troubleshooting procedures.
		Check for 110-115 VAC supply voltage to the timer board and voltage output from timerboards to solenoid valves. Consult DPM/ DPC Pulse Control Panel <i>Installation and Operation Manual</i> for additional assistance.
	DPC not properly adjusted.	Reduce high set-point on DPC to 3" (76 mm). Reduce low set-point on DPC to 2.5" (64 mm) (refer to Section 5.4 or DPM/ DPC Pulse Control Panel <i>Installation and Operation Manual</i> ).
	Pulse system not properly adjusted.	Check for proper pulse valve operation (refer to Section 5 or DPM/DPC Pulse Control Panel <i>Installation and Operation Manual</i> ). Replace damaged parts as necessary.
	Pulse settings incorrect.	Adjust pulse duration to 0.100 seconds (position 3). Adjust pulse delay interval to 10 seconds (position 2). Consult DPC/ DPM Pulse Control Panel <i>Installation and Operation Manual</i> for additional assistance.
	Dust storage drum is full.	Empty drum and clean out hopper (refer to Section 6.3).
	Filters are at the end of their service life.	Replace cartridge filters with ProTura® Nanofiber cartridge filters from UAS. Each cartridge filter has a filter part number affixed to end cap (refer to Table 2 for the ProTura® Nanofiber cartridge filters).
	Air inlet and/or outlet ducting are undersized.	Increase air inlet and/or ducting sizes to reduce duct line static pressure losses. Follow ducting design methods as listed in <i>Industrial Ventilation Manual</i> by American Conference of Governmental Industrial Hygienists.

## 7. ILLUSTRATED PARTS

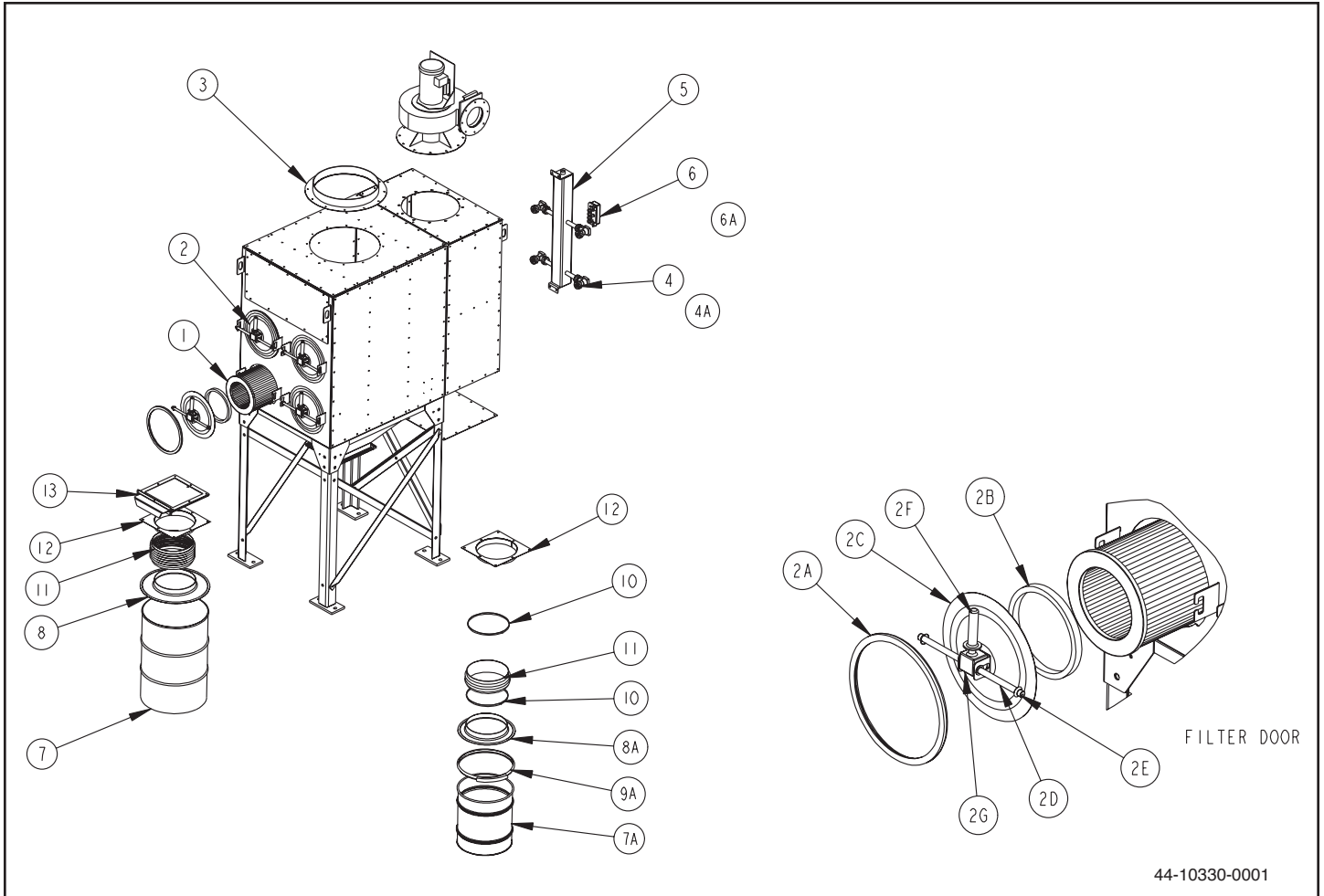


FIGURE 21 SFC Series

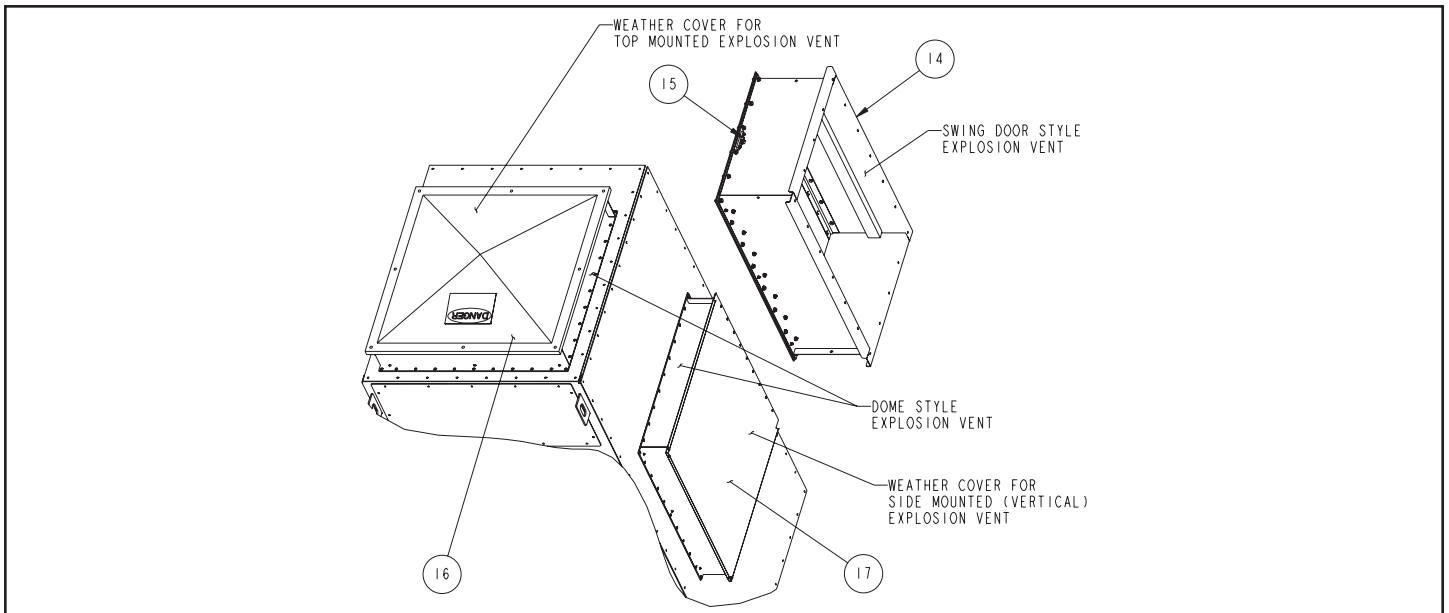


FIGURE 22 SFC Series Explosion Vents



## SFC DUST COLLECTOR BILL OF MATERIALS

Item	Part No.	Description
1		Filter (Consult UAS)
2	02-10019-0001	QuickSeal Filter Access Door Assembly
	02-10019-0002	High Temp QuickSeal Filter Access Door Assembly
	02-10019-0003	QuickSeal Filter Access Door Assembly, Exp Type
2A	42-10002-0001	External Filter Door Seal Gasket
	42-10002-0003	High Temp External Filter Door Seal Gasket
2B	42-10005-0001	Internal Filter Door Seal Gasket
	42-10005-0002	High Temp Internal Filter Door Seal Gasket
2C	10-10079-0001	Door Panel
2D	10-10143-0001	Door Rod
2E	10-10193-0001	Stainless Steel Door Rod End Caps
2F	39-10002-0001	Handle Grip
2G	39-10003-0001	Door Handle
3		Inlet Collar (Consult UAS)
4	07-10002-0001	Diaphragm Valve
4A	07-10003-0001	Diaphragm Valve Repair Kit
5		Compressed Air Manifold (Consult UAS)
6	20-10076-00XX	Solenoid Enclosure (Consult UAS)
6A	20-10076-RPR	Solenoid Repair Kit
6B	20-10076-RPLC	Solenoid Valve Replacement
7	45-0237	55-Gallon (208 Liter) Drum
7A	45-10024-0020	20-Gallon (76 Liter) Drum
8	45-10034-0055	55 Gallon Drum Lid
8A	45-10034-0020	20 Gallon Drum Lid
9	45-10022-0055	55 Gallon Quick Release Collar
9A	45-10022-0020	20 Gallon Drum Quick Release Collar
10	15-0233	14" Hose Clamp
11	15-0202	14" Flexible Duct
12	18-0944	14" Adapter Plate
13	02-6041	14" Slide Gate
14	12-10011	Rupture Panel, Dome 36X36
	12-10012	Rupture Panel, Dome 12X18
	12-10013	Rupture Panel, Dome 18X35
	02-10586-0001	Asm, Explosion Vent, 45x28
	02-10618-0001	Asm, Explosion Vent, 32x19
	02-10618-0002	Asm, Explosion Vent, 16x19
	12-10007-3636	Rupture Panel, Flat, 36x36 (Pre Oct 2012)
	12-10006-1618	Rupture Panel, Flat, 16x18 (Pre Oct 2012)
	12-10001-1836	Rupture Panel, Flat, 18x36 (Pre Oct 2012)
15	10-11358-0001	Clip, Fmd, Exp Vent, 45x28
	10-11358-0002	Clip, Fmd, Exp Vent, 14 GA, 32x19
	10-11358-0003	Clip, Fmd, Exp Vent, 16 GA, 16x19
16	12-10005-3636	Weather Cover, Rupture Panel, 36x36
	12-10005-1836	Weather Cover, Rupture Panel, 18x36
	12-10005-1618	Weather Cover, Rupture Panel, 16x18
	12-10008-1619	Weather Cover, Top Mount, 16x19
	12-10008-1932	Weather Cover, Top Mount, 19x32
	12-10008-2845	Weather Cover, Top Mount, 28x45
	12-10014-1218	Weather Cover, Top Mount, 12x18
	12-10014-1835	Weather Cover, Top Mount, 18x35
17	10-11392-0001	Weather Cover, Side Mount, 45x28
	10-11602-0004	Weather Cover, Side Mount, 32x19
	10-11602-0002	Weather Cover, Side Mount, 16x18

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## **CLARCOR INDUSTRIAL AIR LIMITED WARRANTY**

UAS warrants to the original purchaser that all equipment will be free from defects in materials and workmanship for one year from the date of shipment from UAS (three years for Smokeeter® and VisionAir™ models other than CC and DC series) and that major structural components on SFC and MCB series will be free from defects in materials and workmanship for ten years from the date of shipment from UAS. This warranty applies only if equipment is properly installed, maintained, and operated under normal conditions and does not apply to damage caused by corrosion, abrasion, abnormal use or misuse, misapplication, or normal wear and tear. This warranty will be void with respect to equipment that is subject to unauthorized repairs or modifications. UAS makes no warranty as to goods manufactured or supplied by others. This warranty is subject to any limitations in UAS' quotation and may not be modified except by a written instrument signed by the President or Vice President of Sales of UAS.

THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NONINFRINGEMENT.

As Purchaser's exclusive remedy for any defects in the equipment, UAS will exchange or repair any defective parts during the warranty period, provided such parts are returned, prepaid, to UAS' factory. The obligation of UAS is limited to furnishing replacement parts F.O.B. UAS' factory or making repairs at UAS' factory of any parts that are determined, upon inspection by UAS, to be defective. In no event will UAS be responsible for labor or transportation charges for the removal, reshipment or reinstallation of the parts.

IN NO EVENT WILL UAS BE RESPONSIBLE FOR ANY SPECIAL OR CONSEQUENTIAL DAMAGES.

WARRANTY REGISTRATION: Register online at [www.uasinc.com/registration.aspx](http://www.uasinc.com/registration.aspx)



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**United Air Specialists, Inc.**

a CLARCOR company

## Advanced Nanofiber Filtration Technology

### TECHNICAL DATA

**Tel: 888-515-8800**

#### **FILTER CARTRIDGE SPECIFICATIONS**

**ITEM NUMBER: 33-10089**

<b>Dimensions:</b>	<b>Height:</b>	26"
	<b>Outside Diameter:</b>	13.84"
	<b>Inside Diameter:</b>	9.479"
<b>Top End Cap:</b>	<b>Material:</b>	Electro Galvanized (22 ga)
	<b>Style:</b>	Open
<b>Bottom End cap:</b>	<b>Material:</b>	Electro Galvanized (22 ga)
	<b>Style:</b>	Open
	<b>Bolt Hole:</b>	
<b>Gasket:</b>	1/2" x 1/2" x 11.75" ID isoprene sponge applied on top cap	
<b>Inner Retainer:</b>	Electro galvanized expanded metal 3/8" x 5/8" (9.53 mm x 15.88 mm) 72% open area	
<b>Outer Retainer:</b>	Electro galvanized expanded metal 3/8" x 5/8" (9.53 mm x 15.88 mm) 72% open area	
<b>Filter Media Area:</b>	254 ft <sup>2</sup>	
<b>Pleat Count:</b>	368 +/- 2	
<b>Media Type:</b>	Nanofiber Technology	
<b>Permeability:</b>	20 cfm/ft <sup>2</sup> @ 0.5" w.g. 160 L/sec/m <sup>2</sup> @ ΔP 20 mm w.g.	
<b>Maximum Temperature:</b>	180° F (82.22° C)	
<b>Minimum Efficiency Reporting Value:</b>	Merv 15 @ 500 cfm	
<b>Initial Efficiency:</b>	99.999% @ 0.5 micron	

## OWNER'S MANUAL

### Pulse Control Panel | DPM/DPC

DUST COLLECTION TANK  
CONTROL PANEL.  
TAG NUMBER: 60-LCP-12-4.



## KNOW YOUR EQUIPMENT

READ THIS MANUAL FIRST.

Your Pulse Control Panel should provide years of trouble-free service. This manual will help you understand the operation of your new panel. It will also help you understand how to maintain it in order to achieve top performance. For quick future reference, fill in the spaces below. Should you need assistance, call the United Air Specialists, Inc. customer service number shown below. To expedite your service, have the following information available when contacting UAS.

UAS ORDER #: \_\_\_\_\_

UNIT MODEL #: \_\_\_\_\_

UNIT SERIAL #: \_\_\_\_\_

SYSTEM ACCESSORIES:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

INSTALLATION DATE: \_\_\_\_\_

**UNITED AIR SPECIALISTS, INC. CUSTOMER SERVICE**

**1-800-252-4647**



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## SAFETY PRECAUTIONS

We have provided many important safety messages in this manual. Always read and obey all safety messages.



This is the safety alert symbol.

This symbol alerts you to potential hazards that can kill or hurt you and others. All safety messages will follow the safety alert symbol and the word “DANGER”, “WARNING” or “CAUTION”. These words mean:



**DANGER**

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.



**WARNING**

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



**CAUTION**

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

**CAUTION**

CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

## IMPORTANT SAFETY INSTRUCTIONS



**WARNING**

To reduce the risk of fire, electric shock, or injury when using the air cleaner, follow these basic precautions:

- Use proper lifting and rigging equipment to install your dust collector.
- The dust collector should be properly grounded.
- Disconnect power before servicing.
- Replace all access panels before operating.
- Electrical connections should only be made by qualified personnel, and be in accordance with local and national codes and regulations.
- Do not use in explosive atmospheres unless the dust collector is equipped with the appropriate accessories.
- Keep flammable materials and vapors, such as gasoline, away from dust collector.
- The unit should be inspected frequently and dirt removed to prevent excessive accumulation which may result in flash-over or fire damage.
- Operate only in a safe and serviceable condition.
- Do not allow any individual to put lit cigarettes or any burning objects into the hood or ducting of any dust control system.

## 1. PULSE TIMER BOARD

Before making changes to the pulse timer board, please read this manual. The integrated circuit of the pulse timer board has been designed to sequence solenoid valves that supply pulses of compressed air to dust collector cartridge filters. Unless otherwise specified, the pulse timer board is factory set to a 0.1 second pulse duration, a 10 second pulse delay, 10 solenoid valve outputs and 0 downtime cleaning cycles. The Customer is responsible for setting the correct number of outputs, (SW6), required to match their system. The pulse timer board will have a factory installed jumper at the MOT AUX terminals unless a blower/motor starter is supplied with the equipment.

### ! IMPORTANT

When an auxiliary isolated dry contact is supplied with a blower/motor starter, the MOT AUX jumper must be removed from the pulse timer board for downtime cleaning to be performed.

### ! CAUTION

Do not install the pulse timer board enclosure on the dust cleaning equipment due to vibration.

### 1.1 SPECIFICATIONS

Model 20-3048	
<b>Power Requirement:</b>	120 or 240 VAC 50/60 hz, 150va
<b>Fusing:</b>	250mA Logic, 2A Output
<b>Operating Temperature:</b>	-40°F to 140°F (-40°C to 60°C)
<b>Outputs:</b>	(10) Solid State Switches @ 2 amps max. each
<b>Pressure Switch Input (PRESS SW):</b>	Isolated contact required, normally open
<b>Motor Starter Aux. Input (MOT AUX):</b>	Isolated contact required, normally open
<b>Maximum Number of Valves:</b>	10 Per Output

### 1.2 RANGE ADJUSTMENTS

SWITCH POSITION	DT CYCLES	# OF OUTS	PULSE DURATION	PULSE DELAY
Use a #4 screwdriver to dial in the appropriate value:  (SW7-4)	The number of downtime cleaning cycles performed upon blower shutdown:  (SW7)	The number of outputs (values) selected in the sequence:  (SW6)	The length of time each output is active during a pulse cycle: (seconds) (SW5)	The length of time before the next pulse in the sequence: (seconds) (SW4)
1	1	1	0.025	5
2	2	2	0.050	10
3	3	3	0.100	20
4	4	4	0.125	40
5	5	5	0.150	60
6	6	6	0.175	120
7	7	7	0.200	300
8	8	8	0.500	600
9	9	9	1.000	Unused
0	0	10	Unused	Unused

## ⚠ WARNING

Excessive downtime cleaning could pulse dust from unit out of incoming ducting.

### 1.3 OPERATION

#### 1.1.1 CONTINUOUS CLEAN OPERATION

When using a Digital Pressure Monitor (DPM), or no pressure gauge at all, SW2 on the timer board should be set to CONTINUOUS CLEAN operation. Whenever the blower is active, the system will continuously pulse the cartridges. During continuous clean operation, the CLEAN light will be illuminated.

#### 1.1.2 PRESSURE SWITCH OPERATION

A separate pressure switch or Digital Pressure Controller (DPC) isolated dry contact should be supplied and wired to the PRESS SW terminals on TB3. SW2 on the timer board should be set to PS (pressure switch) operation. When the blower is active, the system will pulse "On Demand" whenever the pressure switch or DPC isolated dry contact is in the closed position. The CLEAN light will be illuminated whenever this dry contact is closed.

### 1.1.3 DOWNTIME CLEANING OPERATION

Upon motor/blower shutdown, downtime cleaning can be performed in either pressure switch mode or continuous clean mode. To perform downtime cleaning, make certain the rotary switch labeled DT CYCLES is set to the number of cycles desired (1 on the switch indicates 1 cycle). Make certain an isolated normally open motor starter auxiliary contact is wired to the MOT AUX terminals on pulse timer board when no jumper is installed at the MOT AUX terminals. During a downtime cleaning, the CLEAN light will flash for the duration of the cycles selected. The down time pulsing will begin 60 seconds after the motorblower is turned off.

### 1.4 CONNECTION DIAGRAMS

Figure 1 shows the connection required for system pulse cleaning operation. The MOT AUX terminals on the timer board will have a factory installed jumper when the MOT AUX terminals are not wired to an isolated normally open motor starter auxiliary contact. This is required for either DPC, a DPM or no pressure gauge at all. When using a DPM, make certain the SW2 is placed in the CONTINUOUS CLEAN position. When using a DPC, make certain SW2 is placed in the PS position.

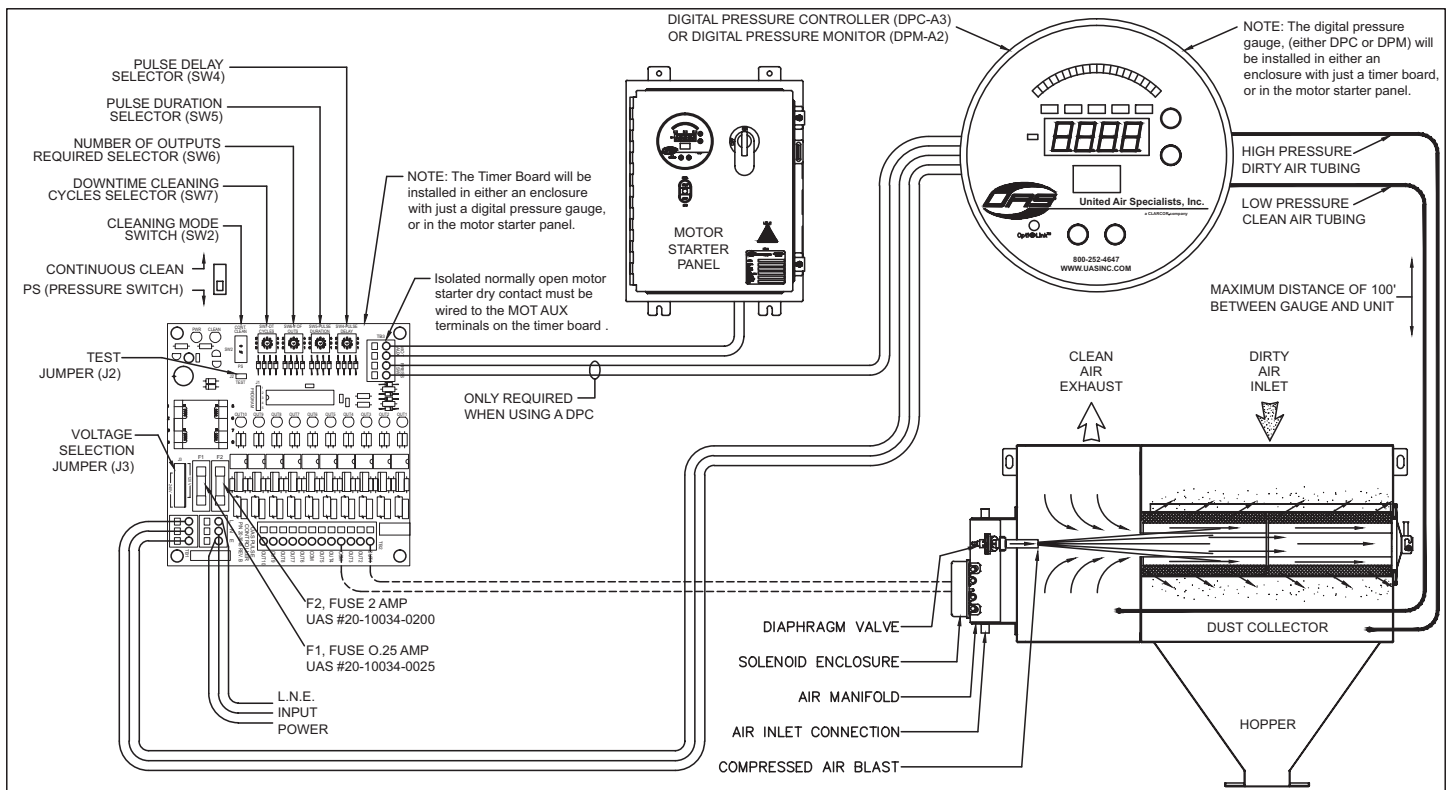
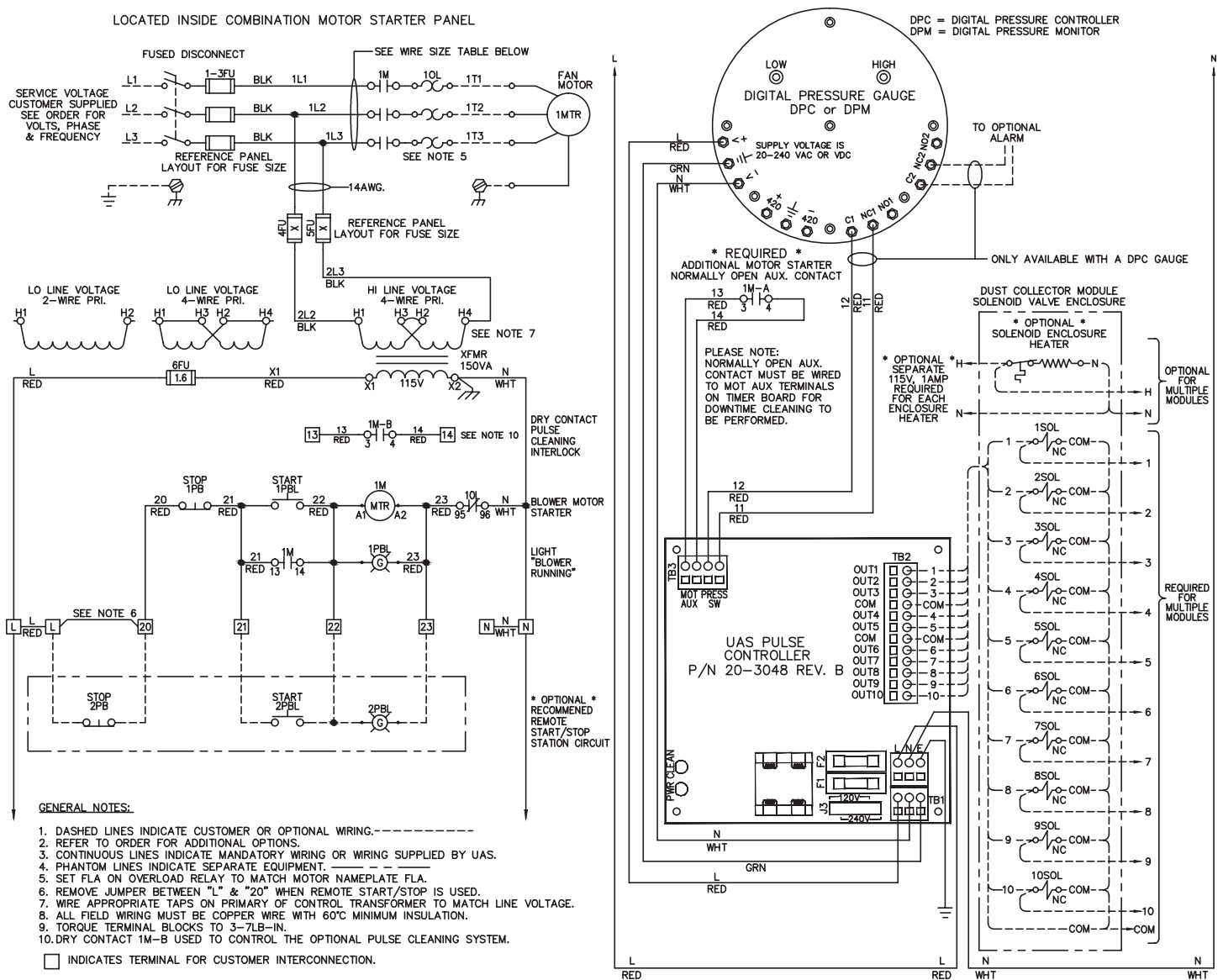


Figure 1  
System Pulse Cleaning Operation

Figure 2 shows recommended interconnections between a separate combination motor starter with a 115VAC step-down transformer, either a DPC or a DPM, and a pulse timer board (20-3048).



**Figure 2**  
**Standard Pulse Timer Board Connections**

Customer Installation of units must follow all local electrical codes or the NFPA 70 (NEC70) code. It is recommended that prior to installation the customer consults with an qualified Electrician or Electrical Engineer for installation meeting the perspective codes.

#### NOTES:

- All service disconnect wiring must follow NFPA 70 (i.e. NEC 70) code.
- For Single phase service disconnect wiring must follow NFPA 70 refer to 310.15(B)(7) chart.
- For Three phase service disconnect wiring must follow NFPA 70 refer to 310.15(B) for proper usage of wire in your installation.
- The provided wiring diagram is a general diagram for reference. Always refer to the system provided wiring diagrams for installation.

## 1.5 TROUBLESHOOTING GUIDE

Use the troubleshooting guide (below) to correct any problems that occur with your dust collection unit. If the problem or condition continues, contact UAS customer service at 1-800-252-4647.

PROBLEM	RECOMMENDED SOLUTIONS
Timer board does not operate.	<ol style="list-style-type: none"> <li>1. Be sure the proper power is applied to the terminals at TB1 at all times.</li> <li>2. Be sure an isolated normally open motor starter auxiliary dry contact is wired to the MOT AUX terminals on TB3 or a jumper is installed at the MOT AUX terminals.</li> <li>3. Be sure PULSE DELAY and PULSE DURATION are not set to 0 (zero).</li> <li>4. Check F1 and F2 fuses for open circuit, replace if blown.</li> </ol>
Timer board does not pulse in continuous mode.	<ol style="list-style-type: none"> <li>1. Be sure SW2 is set to CONTINUOUS mode.</li> </ol>
Timer board does not pulse in pressure switch mode.	<ol style="list-style-type: none"> <li>1. Be sure an isolated normally open pressure switch contact is wired to the PRESS SW terminals on TB3.</li> <li>2. Be sure SW2 is set to PS mode.</li> <li>3. Be sure filter pressure drop is above pressure switch setpoint.</li> </ol>
Downtime cleaning does not function.	<ol style="list-style-type: none"> <li>1. Be sure power is applied to the terminals on TB1 even after the motor starter is shut down.</li> <li>2. Be sure an isolated normally open motor starter auxiliary dry contact is wired to the MOT AUX terminals on TB3 or a jumper is installed at the MOT AUX terminals. (Downtime cleaning begins when the blower motor starter is shut down.)</li> <li>3. Be sure DT CYCLES is not set to 0 (zero).</li> </ol>
Expanded operation does not function.	<ol style="list-style-type: none"> <li>1. Make sure one timer board has SW3 set to MASTER and the other timer board has SW3 set to SLAVE.</li> <li>2. Be sure MOT AUX and HANDSHAKING wiring is jumped from one board to the other (see Figure 3).</li> <li>3. Be sure PRESS SW (if used) is jumped from one board to the other (see Figure 3).</li> <li>4. Be sure SW2 switch on both boards, is set to either CONTINUOUS or PS mode. (Both boards should have the same selection.)</li> </ol>

### UAS 10 Channel Pulse Timer Board Test Procedure:

The firmware for the UAS 10 Channel Pulse Timer board contains a test routine for easily testing all of the inputs and outputs on the circuit board. This routine was included in order to reduce the testing time of each circuit board in the manufacturing process. Caution must be used when testing a circuit board with AC power applied. This procedure should be performed only by personnel with sufficient training or experience that they can do it safely.

### Test Procedure:

The steps of the test must be done in order. Skipping steps does not work.

1. Turn off or disconnect AC power.
2. Place a jumper across the J2 (TEST) header pins.
3. Set all rotary switches to the 0 position.
4. Set SW2 to the PS position.
5. Remove any connections to the MOT AUX and PRESS SW terminals.
6. Apply AC power.
7. If both the PWR and CLEAN lights are flashing re-confirm steps 3 – 5. If steps 3 – 5 are correct and both lights continue to flash, there is a problem causing an incorrect input to the microcontroller.
8. If the PWR light is flashing and the CLEAN light is on steady, continue with the following steps.

9. Rotate SW7-DT CYCLES to position 1. The OUT1 light should turn on. The OUT1 position of the terminal block should also be energized with AC power.
10. Rotate SW7-DT CYCLES through positions 2 through 0. The corresponding OUT light and terminal should turn on. **It is normal for some other lights to blink briefly during rotation of the switches.**
11. When switching from position 9 to position 0, the OUT10 light and terminal should turn on for 2 seconds followed by the CLEAN light turning off for 1 second.
12. Repeat steps 9 – 11 for the other 3 rotary switches SW6-# OF OUTS, SW5-PULSE DURATION, and SW4-PULSE DELAY.
13. Set SW2 to the CONT. CLEAN position. OUT1 will turn on for 2 seconds.
14. Use a jumper wire to momentarily connect the two MOT AUX terminals. OUT2 should turn on for 2 seconds.
15. Use a jumper wire to momentarily connect the two PRESS SW terminals. OUT3 should turn on for 2 seconds.
16. Both the PWR and CLEAN lights should now be on steady.
17. Turn off AC power.
18. Remove jumper on J2.
19. **TEST COMPLETE.**



## 2. DIGITAL PRESSURE GAUGES

### 2.1 DPC-A3

#### 2.1.1 MODEL NUMBER CONFIGURATION

The DPC-A3 digital pressure controller provides control of low differential pressure applications for air and other compatible non-combustible gasses. These instruments have a large LED display for pressure indication, a LCD display for programming and additional LEDs to indicate percentage of output, setpoints and alarm status. The instruments are fully programmable from the key pad face or by utilizing the Opti-Link™ communication port for no-touch programming. Options for the instruments include a 4-20 mA output. The base model does not include the 4-20 mA option, which is a special order option.

GAUGE PART NUMBER AND DESCRIPTION		
GAUGE MODEL:	W.C. RANGE:	GAUGE PART #:
07-10010-A3XX	01=0"-1"W.C.	07-10010-A301
	02=0"-2"W.C.	07-10010-A302
	03=0"-3"W.C.	07-10010-A303
	04=0"-4"W.C.	07-10010-A304
	05=0"-5"W.C.	07-10010-A305
	08=0"-8"W.C.	07-10010-A308
	10=0"-10"W.C.	07-10010-A310
	15=0"-15"W.C.	07-10010-A315

#### 2.1.2 SPECIFICATIONS

**Maximum Pressure:** Ranges  $\leq 4"$  w.c. = 2 PSI;  
Ranges  $\geq 5"$  w.c. = 10 PSI

**Media compatibility:** Air and compatible non-combustible, non corrosive gasses

**Accuracy:** - 1.00%

**Temperature Ranges:**

**Compensated:** 10° to 140°F (-12° to 60°C)

**Operating:** 10° to 140°F (-12° to 60°C)

**Thermal Effect:** +/- 0.02% FS/°F

**Output Signal:** 4-20 mA (option)

**Loop Resistance:** 750  $\Omega$  Max (for internally sourced power); 1800  $\Omega$  Max (for externally sourced power of 36 VDC)

**Power Supply:** Universal 20-240 VAC or VDC

**Housing Material:** Glass Filled Nylon

**Enclosure Rating:** Designed to meet NEMA 4X face

**Relays:** (2) SPDT 8 Amps @ 250 VAC resistive, 5A @30 VDC

**Electrical Connections:** screw terminals

**Response Time:** <100 ms

**Display:** 4 Digit, red LED, 1/2" digits;  
LCD programming display

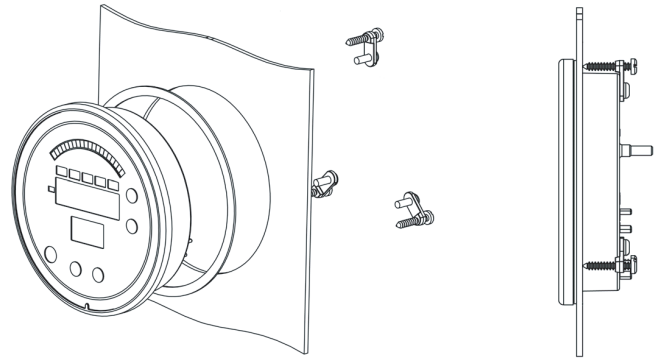
**Process Connection:** Push on connection for 3/16" tubing

**Agency Approvals:** ETL, CE

### 2.1.3 INSTALLATION

#### 2.1.3.1 MOUNTING

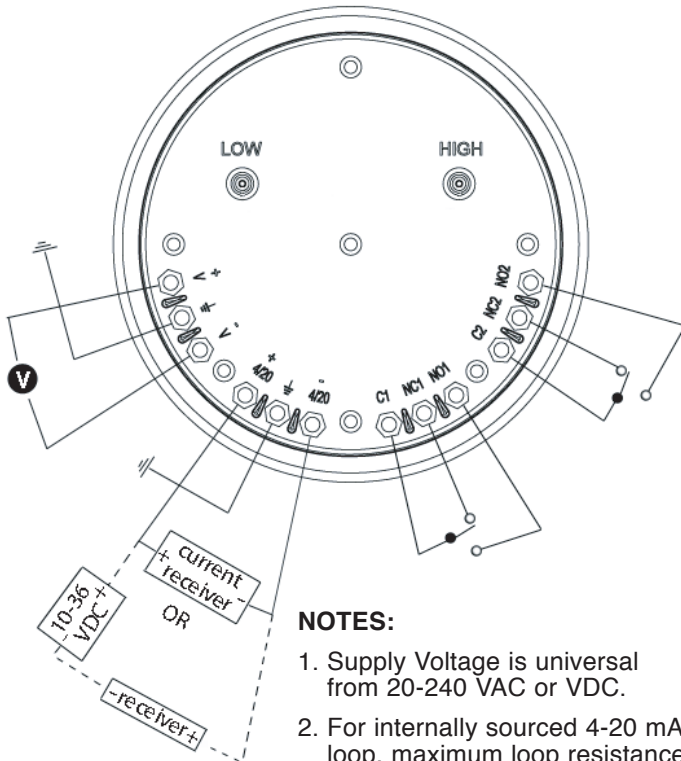
**Flush Mounting** – For new applications, cut a 4-9/16" hole in the panel. Insert the control with the provided gasket through the hole and secure it to the panel with the provided mounting tabs and screws. Retrofitting old technology is also easy with the DPC-A3. This gauge has been designed to fit in industry standard holes ranging from 4-9/16" to 4-13/16". Simply remove the old device and insert the new control into the existing cut out.



#### 2.1.3.2 PRESSURE CONNECTIONS

Two 3/16" pressure connections are located on the back of the unit, labeled "High" and "Low". For best results, connect 3/16" I.D. push on tubing to the pressure connections. If the High connection has a greater absolute value than the Low connection, the front display will give a positive value. If the high connection has a lower absolute value than the low connection, the front display will give a negative value.

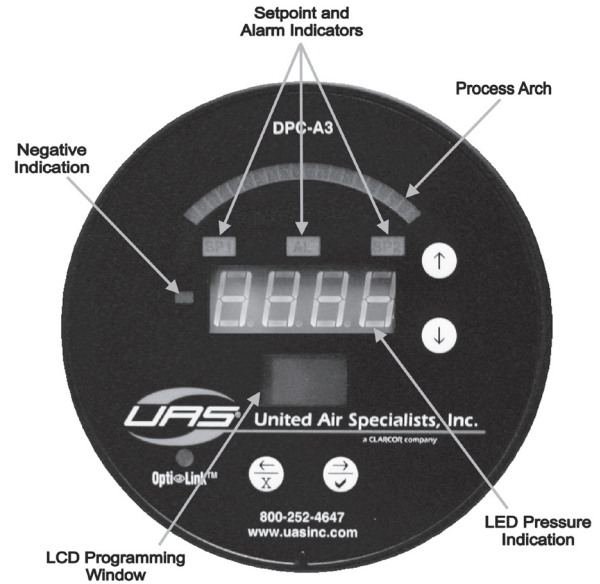
### 2.1.3.3 ELECTRICAL CONNECTIONS



#### NOTES:

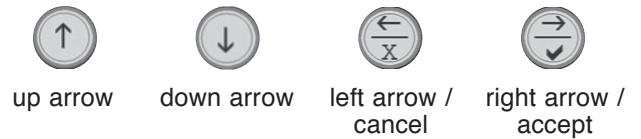
1. Supply Voltage is universal from 20-240 VAC or VDC.
2. For internally sourced 4-20 mA loop, maximum loop resistance is 750  $\Omega$ ; for externally sourced loop at 36 VDC, maximum loop resistance is 1800  $\Omega$ .  
Note: The base model does not include the 4-20 mA option. That is a special order option. Please contact UAS to purchase this.
3. Isolation:  
Relays: 1000 VAC to all other inputs and outputs  
4-20 mA: 5000 VAC to all other inputs and outputs.

### 2.1.4 OPERATION



#### 2.1.4.1 DISPLAY KEY FUNCTION

The DPC-A3 has four buttons located on the face of the control used for programming an up arrow, down arrow, left arrow/cancel and a right arrow/accept button as shown below.



To move from one program menu to another, hold the up arrow or down arrow for one second to move up or down one menu level. The control will start in the "Main" menu, one level up is the "Set-up" menu, and one more level up is the "Secure" menu.

The up and down arrows are used to navigate up and down through the parameters in each menu. To change a parameter, use the up and down arrows until the parameter is highlighted, then press the right arrow. This will advance you to another screen where you can change the parameter. There are two different types of parameter change screens: 1) You select a given option or 2) You change a numerical value. To change a number, use the left and right arrows to select the digit you would like to change, and the up and down arrow to increase or decrease the value by the amount selected. Once you have made the change, hold the accept button down for three seconds. This will accept the change and take you back to the menu you were currently in. At any point while in a parameter change screen, you can hold the cancel button for one second to return to the previous menu without accepting a change to that parameter.

To manually reset the alarm after an alarm condition has occurred (if this feature is used) hold the right and left arrows simultaneously until the alarm resets.



## 2.1.5 PROGRAMMING

The main menu consists of Set Point 1 Low (SP 1 lo), Set Point 1 High (SP 1 hi), Set Point 2 Low (SP 2 lo), and Set Point 2 High (SP 2 hi). SP 1 lo and SP 1 hi is the pulse cleaning for the dust collection system with SP1 lo set at 2.5 and SP 1 hi set at 3.0. Pulse cleaning will activate at 3.0 and deactivate at 2.5. There will be an occurrence in the service life of the filters in which the pulse cleaning will not recover at SP1 lo of 2.5 requiring a setting revision to Sp 1 lo and SP 1 hi. A setting revision should be completed in increments of 0.5 during the service life of the filters. The next setting of SP 1 lo would be 3.0 with SP 1 hi at 3.5. Set Point 2 Low and Set Point 2 High is an alarm range indicating filters will require a replacement. The filters should only be replaced when process ventilation is unsatisfactory.

MENU	VARIABLE	CODE	SETTING
Main Menu	↻ Set Point 1 Low	SP1 lo	2.5
	↻ Set Point 1 High	SP1 hi	3.0
	↻ Set Point 2 Low	SP2 lo	3.5
	↻ Set Point 2 High	SP2 hi	5.0

## 2.1.6 OPTI-LINK™

Opti-link™ is an infrared communications technology that allows the user to upload and download program parameters from one unit to another with a programming key. By using the PK-01 universal programming key, the user may program one unit, download those parameters to the universal programming key and then upload that same program from the key to other controls. By using a PK-02 lockout programming key, a user may completely lock (or unlock) the face keypad of the control to eliminate the possibility of unwanted tampering of the control.

To download programs from a control to a programming key, place the key within 1 to 6 inches of the Opti-Link™ port on the control and hold the two outside buttons simultaneously until the numeric LED on the control turns off. The programming key should stay within the 1 to 6 inch range while the download is in progress. During the operation, the Process Arch on the control will give the status of the download. When the download is complete, the programming key will blink green twice to indicate the program is stored on the programming key.

To upload programs from a programming key to a control, place the key within 1 to 6 inches of the Opti-Link™ port on the control and hold the center button until the numeric LED on the control turns off. The programming key should stay within the 1 to 6 inch range while the download is in progress. During the operation, the Process Arch on the control will give the status of the download. When the upload is complete, the control will read "yes" to indicate the program has been successfully uploaded to the control.

## 2.2 DPM-A2

### 2.2.1 MODEL NUMBER CONFIGURATION

The DPM-A2 is a microprocessor based digital pressure gauge for positive, negative and differential measurement designed to be a direct replacement for mechanical gauges. The 1/2" LCD display gives

the gauge improved readability and precision. These products also feature five user selectable engineering units including in. w.c., mm w.c., cm w.c., kPa and Pa. The DPM-A2 also has a "process arch" which gives the gauge a similar look to mechanical gauges by giving a continuous percent output status.

GAUGE PART NUMBER AND DESCRIPTION		
GAUGE MODEL:	IN WC RANGE:	GAUGE PART #:
07-10009-A2XX	01=0"-1"W.C.	07-10009-A201
	02=0"-2"W.C.	07-10009-A202
	03=0"-3"W.C.	07-10009-A203
	04=0"-4"W.C.	07-10009-A204
	05=0"-5"W.C.	07-10009-A205
	08=0"-8"W.C.	07-10009-A208
	10=0"-10"W.C.	07-10009-A210
	15=0"-15"W.C.	07-10009-A215

### 2.2.2 SPECIFICATIONS

**Maximum Pressure:** Ranges ≤ 4" w.c. = 2 PSI;  
Ranges ≥ 5" w.c. = 10 PSI

**Media compatibility:** Air and compatible non-combustible, non corrosive gasses

**Accuracy:** - 1.00%

**Temperature Ranges:**

**Compensated:** -10° to 140°F (-23° to 60°C)

**Operating:** -10° to 140°F (-23° to 60°C)

**Thermal Effect:** +/- 0.02% FS/°F

**Output Signal:** 4-20 mA (option)

**Loop Resistance:** 750 Ω Max (for internally sourced power); 1800 Ω Max (for externally sourced power of 36 VDC)

**Power Supply:** Universal 20-240 VAC or VDC

**Housing Material:** Glass Filled Nylon

**Enclosure Rating:** Designed to meet NEMA 4X face

**Electrical Connections:** screw terminals

**Response Time:** <100 ms

**Display:** 4 Digit, red LED, 1/2" digits;

**Process Connection:** Push on connection for 3/16" tubing

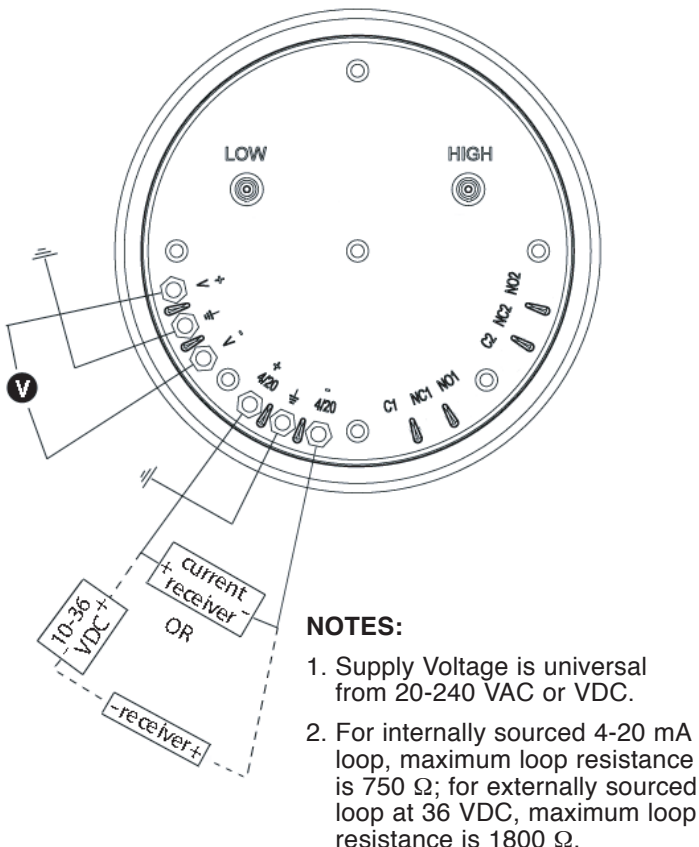
**Agency Approvals:** ETL, CE

## 2.2.3 INSTALLATION

### 2.2.3.1 PRESSURE CONNECTION

Two 3/16" pressure connections are located on the back of the unit, labeled "High" and "Low". For best results, connect 3/16" I.D. push on tubing to the pressure connections. If the High connection has a greater absolute value than the Low connection, the front display will give a positive value. If the High connection has a lower absolute value than the Low connection, the front display will give a negative value.

### 2.2.3.2 ELECTRICAL CONNECTION



3. Isolation: 4-20 mA: 5000 VAC to all other inputs and outputs. Note: The base model does not include the 4-20 mA option. That is a special order option. Please contact UAS to purchase this.

## 2.2.4 OPERATION

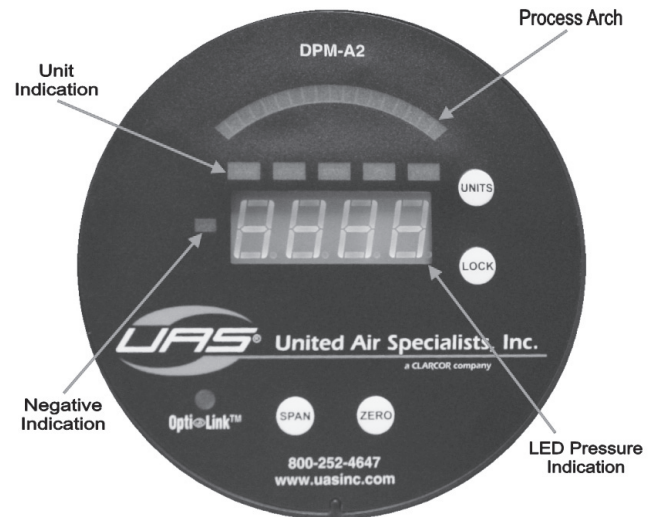
### 2.2.4.1 DISPLAY

The DPM-A2 displays pressure on a four digit LED display and will show three or four digits depending on the range and accuracy of the product. Negative pressure will be indicated by a negative sign before the numerical indication. Units of measure are displayed above the four digit LED display by LED indicators. The DPM-A2 also has a process arch, which is designed to mimic the indicating needle of a mechanical gauge. The process arch will light up from left to right as the pressure moves away from zero.

### 2.2.4.2 KEY FUNCTION

The DPM-A2 has four buttons located on the face of the gauge for set-up and calibration. There is a Span, Zero, Units, and Lock button. The Units button changes the unit of measure and the Lock button locks and unlocks the keypad on the gauge. Span and Zero are used for calibration (see calibration section 2.2.5.2).

By simultaneously pressing the Span and Zero buttons for three seconds, the unit will be switched from internally sourcing the power for the current loop to requiring an external power supply.



## 2.2.5 OTHER FEATURES

### 2.2.5.1 OPTI-LINK™

Opti-link™ is an infrared communications technology that allows the user to upload and download program parameters from one unit to another with a programming key. By using the PK-01 universal programming key, the user may program one unit, download those parameters to the universal programming key and then upload that same program from the key to other controls. By using a PK-02 lockout programming key, a user may completely lock (or unlock) the face keypad of the control to eliminate the possibility of unwanted tampering of the control.

### 2.2.5.2 CALIBRATION

**ZERO** - Periodically, it may be necessary to recalibrate the gauge to maintain the accuracy of the product. To "Zero" the gauge, remove the pressure connections from both pressure ports and hold the Zero button for three seconds.

**SPAN - THIS FUNCTION SHOULD ONLY BE PERFORMED BY CERTIFIED PERSONNEL.**

This is a calibration parameter that allows re-calibration of the span. To re-span the gauge, you'll need a device that can maintain a fixed amount of negative pressure. For example, if your gauge goes to 8" inwc, then you'll

need to apply 8" inwc of negative pressure to the LOW pressure port on the gauge. Nothing should be connected to the HIGH pressure port. You can reset the value by holding the Span key for three seconds.

The 4-20 mA process output is set to give a linear output from 0 to the full scale pressure range of the product. Other pressure spans such as bidirectional or reduced ranges can be scaled with an Opti-Link™ programming key. Consult the factory for details.

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## **CLARCOR INDUSTRIAL AIR LIMITED WARRANTY**

UAS warrants to the original purchaser that all equipment will be free from defects in materials and workmanship for one year from the date of shipment from UAS (three years for Smokeeter® and VisionAir™ models other than CC and DC series) and that major structural components on SFC and MCB series will be free from defects in materials and workmanship for ten years from the date of shipment from UAS. This warranty applies only if equipment is properly installed, maintained, and operated under normal conditions and does not apply to damage caused by corrosion, abrasion, abnormal use or misuse, misapplication, or normal wear and tear. This warranty will be void with respect to equipment that is subject to unauthorized repairs or modifications. UAS makes no warranty as to goods manufactured or supplied by others. This warranty is subject to any limitations in UAS' quotation and may not be modified except by a written instrument signed by the President or Vice President of Sales of UAS.

THIS WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NONINFRINGEMENT.

As Purchaser's exclusive remedy for any defects in the equipment, UAS will exchange or repair any defective parts during the warranty period, provided such parts are returned, prepaid, to UAS' factory. The obligation of UAS is limited to furnishing replacement parts F.O.B. UAS' factory or making repairs at UAS' factory of any parts that are determined, upon inspection by UAS, to be defective. In no event will UAS be responsible for labor or transportation charges for the removal, reshipment or reinstallation of the parts.

IN NO EVENT WILL UAS BE RESPONSIBLE FOR ANY SPECIAL OR CONSEQUENTIAL DAMAGES.

WARRANTY REGISTRATION: Register online at [www.uasinc.com/registration.aspx](http://www.uasinc.com/registration.aspx)



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[www.clarcorindustrialair.com](http://www.clarcorindustrialair.com)



# OPERATING & MAINTENANCE INSTRUCTIONS AND PARTS LIST

DUST COLLECTION FAN  
TAG NUMBER: M-12-19.

for  
**HDBI - Backward Inclined Blowers**  
**HDAF - Airfoil Wheel Blowers**  
**RBE - Radial Blade Exhausters**  
**HP - High Pressure Blowers**

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## NOTICE

If fan will not be put into operation within 30 days, obtain long-term storage instructions from our website ([www.cincinnati-fan.com](http://www.cincinnati-fan.com)) or your local Cincinnati Fan Sales Office.

## ⚠ DANGER

ALL FANS AND BLOWERS SHOWN HAVE ROTATING PARTS AND PINCH POINTS. SEVERE PERSONAL INJURY CAN RESULT IF OPERATED WITHOUT GUARDS. STAY AWAY FROM ROTATING EQUIPMENT UNLESS IT IS DISCONNECTED FROM ITS POWER SOURCE AND ALL ROTATING PARTS HAVE STOPPED MOVING.

READ ALL OPERATING INSTRUCTIONS CONTAINED HEREIN  
BEFORE INSTALLING EQUIPMENT.

## ⚠ DANGER

**NO GUARANTEE** OF ANY LEVEL OF SPARK RESISTANCE IS IMPLIED BY SPARK RESISTANT CONSTRUCTION. IT HAS BEEN DEMONSTRATED THAT ALUMINUM IMPELLERS RUBBING ON RUSTY STEEL MAY CAUSE HIGH INTENSITY SPARKS. AIR STREAM MATERIAL AND DEBRIS OR OTHER SYSTEM FACTORS MAY ALSO CAUSE SPARKS.



PART # 01001  
CATALOG #PMK-1001  
SUPERSEDES: PMK-1293

7697 Snider Road, Mason, Ohio 45040-9135 (513) 573-0600

## I. GENERAL SAFETY NOTES

1. Rotating parts including shaft and V-belt drives must be properly guarded to prevent personal injury.
2. Electrical wiring must be accomplished by a qualified electrician in accordance with all applicable codes.
3. Care should be taken:
  - Not to run fan above its safe speed  
(See Performance Tables in Sales Catalog or call **CF** sales office).
  - Not to operate in excessive temperatures  
(See limitations in Sales Catalog or call **CF** sales office).
  - Not to operate in dangerous environments.
  - Read all instructions carefully.

## II. RECEIVING

### Receiving Inspection

When unit is received, inspect immediately for damaged or missing parts. Even though all units are carefully inspected and prepared for shipment at the factory, rough handling en route may cause concealed damage or cause nuts, set screws, bolts or locking collars to work loose. Be certain all fasteners are tightened securely. Rotate wheel by hand to verify that it rotates freely and that there are no obstructions.

Table #1

TORQUE VALUES FOR SPLIT TAPER BUSHINGS	
Bushing Size	MINIMUM RECOMMENDED TORQUE (INCH-LBS)
H	95
B & P	192
Q & R	350

Table #2

SET SCREW TORQUE VALUES		
SET SCREW SIZE		MINIMUM REQUIRED TORQUE (INCH-LBS)
Diameter & No. of Threads/Inch	Hex Size Across Flats (Allen Wrench)	
1/4-20	1/8"	65
5/16-18	5/32"	165
3/8-16	3/16"	228
7/16-14	7/32"	348
1/2-13	1/4"	504
5/8-11	5/16"	1104

**NOTE:** If wheel set screws are loosened and/or wheel is removed from shaft, set screws *must* be replaced. Set screws cannot be used more than once. Use knurled, cup point set screws with a locking patch.

Inspect all shipments carefully for damage. THE RECEIVER MUST NOTE ANY DAMAGE ON THE CARRIER'S BILL OF LADING AND FILE A CLAIM IMMEDIATELY WITH THE FREIGHT COMPANY IN THE CASE OF ANY DAMAGE. Keep a record of all equipment received, including inspection details and date of receipt because of the possibility of partial shipments.

## III. HANDLING

Handle your equipment with care. Some fans are provided with lifting lugs or holes for easy handling. Others must be handled using nylon straps or well-padded chains and cables which protect the fan's coating and housing. Spreader bars should be used when lifting large parts.

Centrifugal fans are best lifted using one strap under the fan's scroll and another strap around the bearing base. DO NOT LIFT CENTRIFUGAL FANS BY THE FAN SHAFT, WHEEL, FLANGES OR INLET SUPPORT OR MOTOR EYE BOLT.

### NOTICE

If fan will not be put into operation within 30 days, obtain long-term storage instructions from our website ([www.cincinnati-fan.com](http://www.cincinnati-fan.com)) or your local Cincinnati Fan Sales Office.

## IV. GENERAL INSTALLATION INSTRUCTIONS

### Foundations

Fan foundation must be flat, level and rigid. Where foundation is not completely flat, shims must be placed under fan support at each anchor bolt as required. Bolting fan to an uneven foundation distorts alignment and causes vibration.

Structural steel foundations should be heavily cross-braced for load support.



## V. OPERATION

### Before Connecting Power

1. Inspect all fasteners and retighten if necessary:
  - a. Foundation bolts.
  - b. Set screws in fan and wheel and V-belt drive (See Tables #1 & #2 on preceding page).
  - c. Housing, bearing and motor mounting.
2. Inspection doors should be tight and sealed.
3. Bearings should be checked for alignment and lubrication (See Bearing Maintenance, pages 4 & 5).
4. Turn rotating assembly by hand to insure that it does not strike housing. If the wheel strikes the housing, the wheel may have moved on the shaft or the bearings may have shifted in transit. Correction *must* be made prior to start up.
5. Check motor to insure proper speed and electrical characteristics.
6. Check V-belt drive for alignment and correct belt tension.
7. After wiring, energize motor for one second to check for proper rotation.

## VI. GENERAL MAINTENANCE

### CAUTION

Before any maintenance or service is performed, assure that unit is disconnected or locked out from power source to prevent accidental starting.

The key to good fan maintenance is a regular and systematic inspection of all fan parts. Severity of the application should determine frequency of inspection. The components requiring service are generally the moving parts which include bearings, fan wheel, belts, sheaves and motor.

### Cast Aluminum & Metal Parts

Cast aluminum and steel parts usually do not require maintenance during the life of the unit except painted metal surfaces that may require periodic repainting. In a severe, dirty operation, the wheel should be cleaned with a wire brush to prevent an accumulation of foreign matter that could result in fan unbalance. After cleaning wheel, inspect for possible cracks or excessive wear, which can cause unbalance. **DO NOT** operate a wheel that is cracked, chipped, has broken blades or excessive wear. NOTE: If wheel set screws are loosened and/or wheel is removed from shaft, set screws *must* be replaced. Set screws cannot be used more than once. Belts on V-belt drive units require periodic inspection and replacement when worn. For multiple belt drives, belts should be replaced with matched sets.

### Motor Maintenance

1. Disconnect or lock out power to motor.
2. Removing dust and dirt: Blow out open type motor windings with low pressure air to remove dust or dirt. Air pressure above 50 P.S.I. should not be used as high pressure may damage insulation and blow dirt under loosened tape. Dust accumulation can cause excessive insulation temperatures.
3. Lubrication: The motor bearings and the fan bearings on the belt drive fans should be greased at regular intervals. Motor manufacturers' greasing instructions and recommendations should be followed closely. Avoid the use of a pressure greasing system which tends to fill the bearing chamber completely. Do not overgrease. Use only 1 or 2 shots with a hand gun in most cases. Maximum hand gun rating 40 P.S.I. Rotate bearings during lubrication where good safety practice permits. NOTE: On motors with non-regreasable sealed bearings, no lubrication is required for the life of the bearings.

To prevent rusting of bearing parts, the rotor must be rotated at regular intervals (30 days) to assure these parts are well covered with oil or grease.

## VII. V-BELT DRIVES

Care should be taken not to overtighten V-belt drive. Excessive belt tension overloads fan and motor bearings. It is much less expensive to replace belts worn from slippage than to replace bearings damaged from excessive loading.

Fans shipped completely assembled have had V-belt drive aligned at the factory. Alignment should be rechecked before operation as a precaution due to handling during shipment.

### A WORD OF CAUTION ABOUT MOTORS

Using your hand to test the running temperature of a motor can be a very painful experience:

Normal body temperature .....	98.6° F
Threshold of pain caused by heat.....	120.0° F
Average temperature of hot tap water.....	140.0° F
Average temperature of hot coffee.....	180.0° F
Normal operating temperature of a fully loaded electric motor open type, 70° F ambient temperature .....	174.0° F

1. Be sure sheaves are locked in position.
  2. Key should be seated firmly in keyway.
  3. Place straight edge or taut cord across faces of driving and driven sheaves to check alignment. The motor and fan shafts must be parallel with V-belts and at right angles to the shafts.
  4. Start the fan. Check for proper rotation. Run fan at full speed. A slight bow should appear on slack side of belt. Disconnect power and adjust belt tension by adjusting motor on its sliding base. All belts must have some slack on one side.
  5. If belts squeal at start up, they may be too loose.
  6. When belts have had time to seat in the sheave grooves, then readjust belt tension. (2-3 days)
- V-belt drive assembly can be mounted as follows:**
1. Clean motor and fan shafts. Be sure they are free from corrosive material. Clean bore of sheaves and coat with heavy oil for ease of shaft entry. Remove oil, grease, rust or burrs from sheave grooves.
  2. Place fan sheave on fan shaft and motor sheave on its shaft. **Do not pound sheaves** on as this may damage bearings. Tighten sheaves per Table #1 or #2 on page 2.

**Table #3** (See Bearing Maintenance, page 5.)

Conditions Around Bearing	Operating Temperature of Fan	**Greasing Intervals
Fairly Clean	up to 120 °F 120°-160°F 160°-200°F plus*	6-12 months 2-3 months 1-2 months
Moderate to Extremely Dirty	up to 160°F 160°-200°F plus*	1-2 months 2-4 weeks
Cold Storage Room		every defrosting period or no more than 4 months
*For fan applications over 200°F: greasing intervals should be from several days to 2 weeks, depending on the temperature.		
**For vertical installations, greasing intervals should be twice as frequent as table values.		

---

The following greases, or one that is equivalent to the general description, are recommended for the following  
temperatures or excessive moisture applications.

Operating Conditions	Use Grease Equivalent to these Grades
Temperatures -65°F to 0°F	Esso-Beacon #325 (-65°F) Mobil Grease #28 (-65°F) Shell Oil Aeroshell No. 7 (-100°F)
General Description: Versatile multipurpose microgel thickened synthetic hydrocarbon grease with corrosion inhibitors, anti-oxidant additives, water resistance tendencies and EP characteristics.	

---

Temperature 0°F to 200°F inclusive (Also use for heavy condensation or direct splash of water)	Mobil Oil - Mobilux EP #2 Shell Oil - Shell Alvania EP #2 Chevron - Chevron SRI #2
General Description: Multipurpose NLGI#2 grease from lithium soap with EP characteristics, rust inhibitors, anti-oxidant additives and good water resistance tendencies.	

---

Temperatures over 200°F	Dow Corning-DC44 (400°F) (Not compatible with non-silicon based greases)
General Description: Versatile multipurpose microgel thickened synthetic hydrocarbon grease with corrosion inhibitors, anti-oxidant additives, water resistance tendencies and EP characteristics.	



3. Move motor on slide base so belts can be placed in grooves of both sheaves without forcing. Do not roll belts or use a tool to force belts over the grooves.
4. Align fan and motor shafts so they are parallel. The belts should be at right angles to the shafts. A straight edge or taut cord placed across the face of the sheaves will aid in alignment.
5. Tighten belts by adjusting motor base. Correct tension gives the best drive efficiency. Excessive tension causes undue bearing pressure.
6. Start the fan and run it at full speed. Adjust belt tension until only a slight bow appears on the slack side of the belts. If slippage occurs, a squeal will be heard at start-up. Eliminate this squeal by **disconnecting or locking out motor from power source** and then tightening up the belts.
7. Give belts a few days running time to become seated in sheave grooves, then readjust belt tension.

If the shafts become scratched or marked, carefully remove sharp edges and high spots such as burrs with fine emery cloth or honing stone. Avoid getting emery dust in the bearings.

Do not apply any belt dressing unless it is recommended by the drive manufacturer. V-belts are designed for frictional contact between the grooves and sides of the belts. Dressing will reduce this friction.

Belt tension on an adjustable pitch drive is obtained by moving the motor, not by changing the pitch diameter of the adjustable sheave.

## VIII. BEARING MAINTENANCE

### Sealed Bearings

Sealed for life bearings are pre-lubricated with the correct amount of manufacturer approved ball bearing grease, and are designed for application where relubrication is not required.

### Relubricatable Bearings

The motor bearings and fan bearings on belt drive fans should be greased at regular intervals. Motor manufacturers greasing instructions and recommendations should be followed closely. Avoid the use of a pressure greasing system which tends to fill the bearing chamber completely. Do not over grease.

**NOTE:** On motors with non-regreasable, sealed bearings, no lubrication is required for the life of the bearing.

**Table #3** (page 4) lists the time intervals between fan greasing to insure proper lubrication in adverse conditions of heat and dust. Use only 1 or 2 shots with a hand gun in most cases. Maximum handgun rating 40 P.S.I.

## IX. WARRANTY

Cincinnati Fan & Ventilator Company warrants products of its own manufacture against defects of material and workmanship under normal use and service for a period of eighteen (18) months from date of shipment or twelve (12) months from date of installation, whichever occurs first.

This warranty does not cover ordinary wear and tear, abuse, misuse, overloading, negligence, alteration or systems and/or materials not of Seller's manufacture. Expenses incurred by Buyer(s) in repairing or replacing any defective product will not be allowed except where authorized in writing and signed by an officer of the Seller.

The obligation of Seller under this warranty shall be limited to repairing or replacing F.O.B. Seller's plant, or allowing credit at Seller's option. This warranty is expressly in lieu of all other warranties expressed or implied including the warranties of merchantability and fitness for use and of all other obligations and liabilities of the Seller. The Buyer acknowledges that no other representations were made to him or relied upon him with respect to the quality or function of the products herein sold.

On equipment furnished by the Seller, but manufactured by others, such as motors, Seller extends the same warranty as Seller receives from the manufacturer thereof. Repairs for motors should be obtained from nearest authorized motor service station for the make of motor furnished. All motors used are products of well-known manufacturers with nationwide service facilities. Check the yellow pages of your telephone directory for the location of the nearest service shop.

Cincinnati Fan & Ventilator Company assumes no responsibility for material returned to our plant without our prior written permission.

## X. ORDERING REPLACEMENT PARTS

Replacement or spare parts may be ordered through your local Cincinnati Fan representative. (Refer to drawings that begin on page 7.) The following information should accompany parts orders:

1. Motor horsepower, frame size, motor speed, voltage, phase, cycle and enclosure. Motor manufacturer's model number from motor nameplate.
2. Fan Speed (if V-belt driven).
3. Fan serial and model numbers from the fan nameplate and a complete description of the part.

An adequate stock of repair parts is maintained where possible. **If your fan is vital to production or to plant operation, it is advisable to have all spare parts on hand to minimize downtime.**

## **XI. TROUBLE SHOOTING**

In the event that trouble is experienced in the field, the following are the most common fan difficulties. These points should be checked in order to prevent needless delay and expense.

### **1. CAPACITY OR PRESSURE BELOW RATING**

- a. Incorrect direction of wheel rotation.
- b. Speed too slow.
- c. Dampers not properly adjusted.
- d. Poor fan inlet or outlet conditions (elbows, restrictions).
- e. Air leaks in system.
- f. Damaged wheel.
- g. Total resistance of system higher than anticipated.
- h. Wheel mounted backwards on shaft.
- i. Fan not properly selected for a high temperature and/or high altitude application.

### **2. VIBRATION AND NOISE**

- a. Misalignment of bearings, coupling, wheel or V-belt drive.
- b. Unstable foundation or supports.
- c. Foreign material in fan causing unbalance.
- d. Worn bearings.
- e. Damaged wheel or motor.
- f. Broken or loose bolts and set screws.
- g. Bent shaft.
- h. Worn coupling.
- i. Fan wheel or drive unbalanced.

- j. 120 cycle magnetic hum due to electrical input. Check for high or unbalanced voltage.
- k. Fan delivering more than rated capacity.
- l. Loose dampers.
- m. Speed too high or fan rotating in wrong direction.
- n. Vibration transmitted to fan from some other source.

### **3. OVERHEATED BEARINGS**

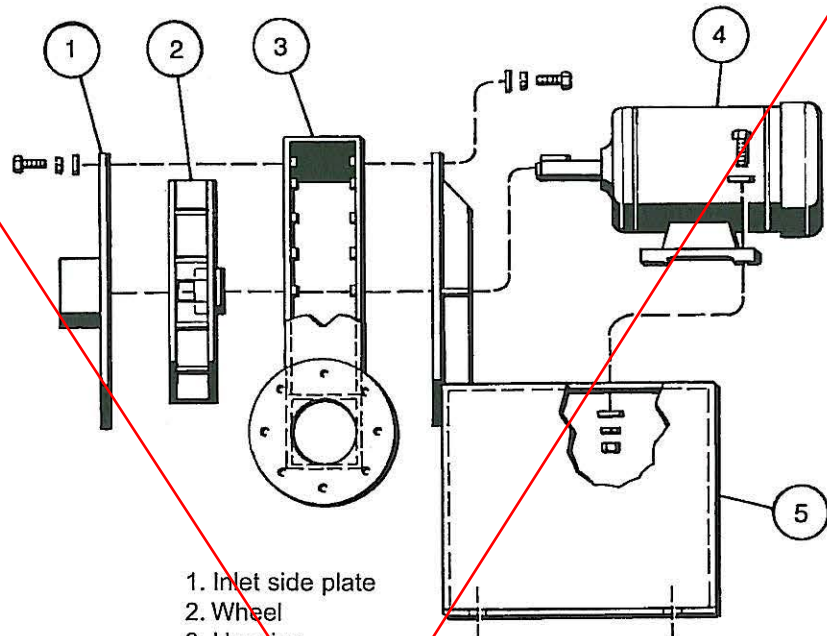
- a. Check bearing lubrication.
- b. Poor alignment.
- c. Damaged wheel or drive.
- d. Bent shaft.
- e. Abnormal end thrust.
- f. Dirt in bearings.
- g. Excessive belt tension.

### **4. OVERLOAD ON MOTOR**

- a. Speed too high.
- b. Fan over capacity due to existing system resistance being lower than original rating.
- c. Specific gravity or density of gas above design value.
- d. Wrong direction of wheel rotation.
- e. Shaft bent.
- f. Poor belt alignment.
- g. Wheel wedging or binding on fan housing.
- h. Bearings improperly lubricated.
- i. Motor improperly wired.
- j. Defective motor. Motor must be tested by motor manufacturer's authorized repair shop.



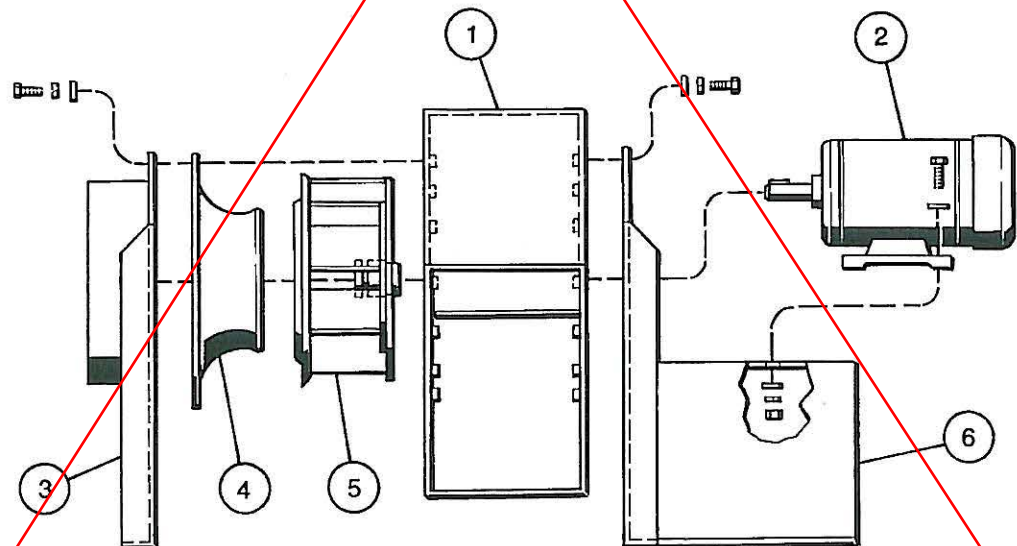
**MODEL HP  
Arrangement 4**



1. Inlet side plate
2. Wheel
3. Housing
4. Motor
5. Base

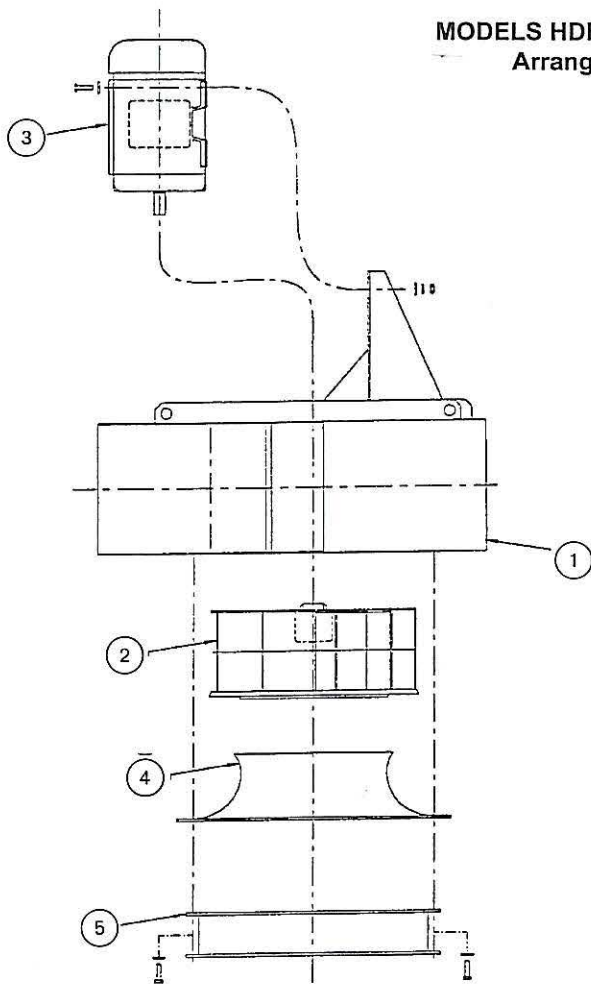
NOTE: Shaft seal is not shown

**MODELS HDBI, HDAF and RBE  
Arrangement 4**



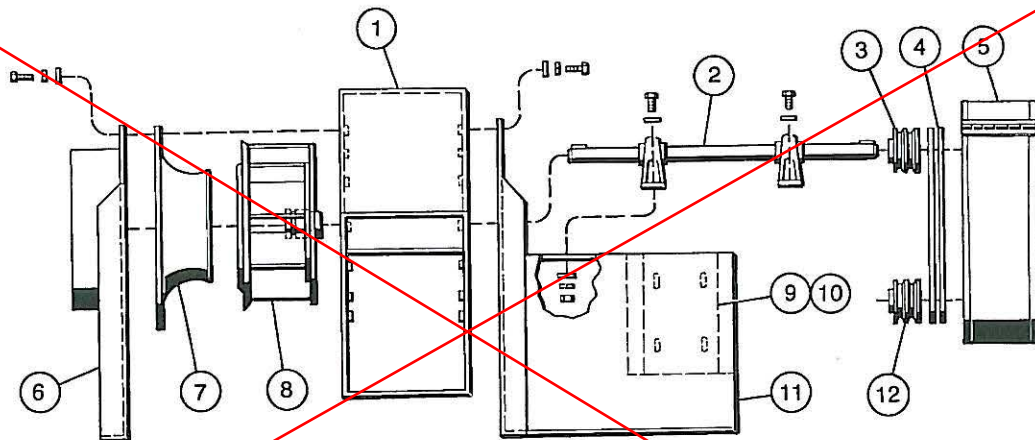
1. Housing
2. Motor
3. Inlet side plate
4. Inlet bell (on models HDBI and HDAF only)
5. Wheel (HDBI wheel shown)
6. Base

**MODELS HDBI, HDAF and RBE  
Arrangement 4HM**



- 1. Housing
- 2. Wheel (HDBI shown)
- 3. Motor
- 4. Inlet bell (HDBI and HDAF only)
- 5. Inlet spool piece (Inlet side plate with optional inlet flange)

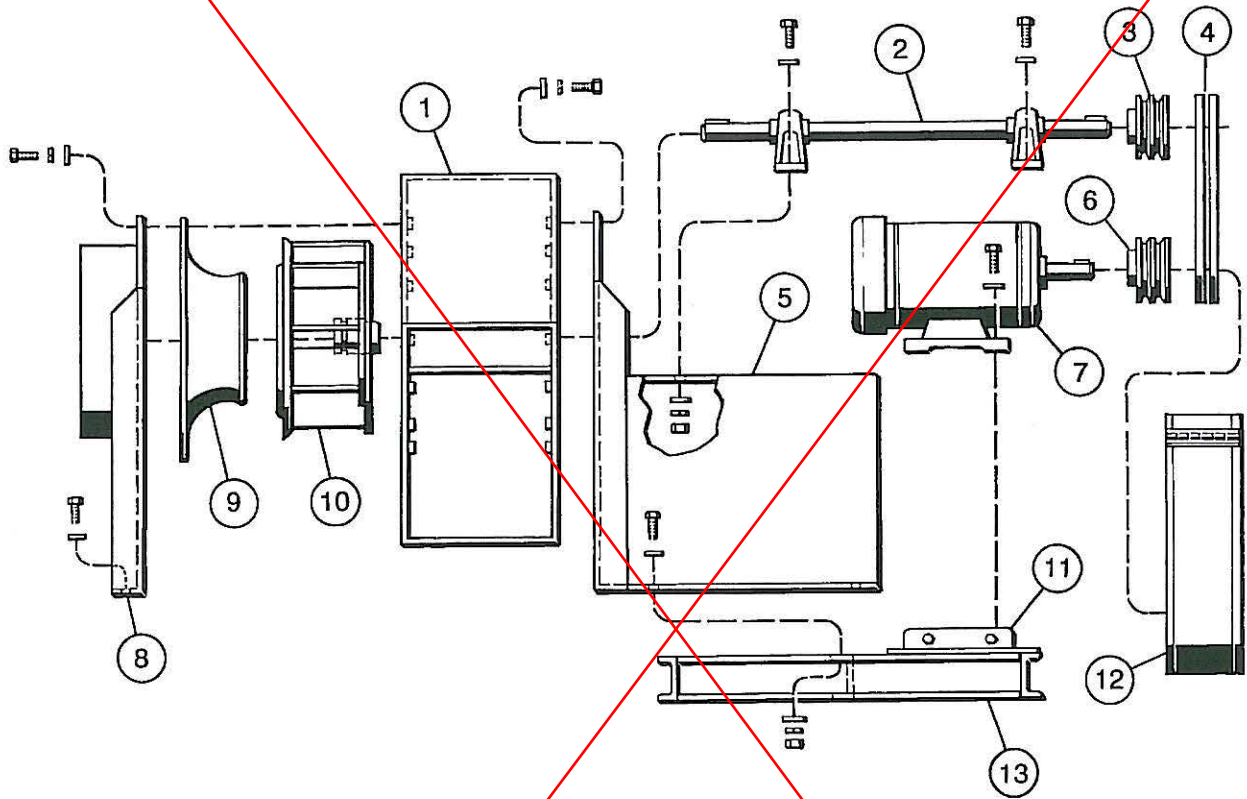
**MODELS HDBI, HDAF and RBE  
Arrangements 1 and 9**



- 1. Housing
- 2. Shaft and bearing assembly
- 3. Fan shaft pulley (Arr. 9 only)
- 4. Belt(s) (Arr. 9 only)
- 5. Belt guard (Arr. 9 only)
- 6. Inlet side plate
- 7. Inlet bell (on Models HDBI and HDAF only)
- 8. Wheel (HDBI wheel shown)
- 9. Motor slide base (Arr. 9 only)
- 10. Motor (Arr. 9 only)\*
- 11. Base, fan
- 12. Motor shaft pulley (Arr. 9 only)

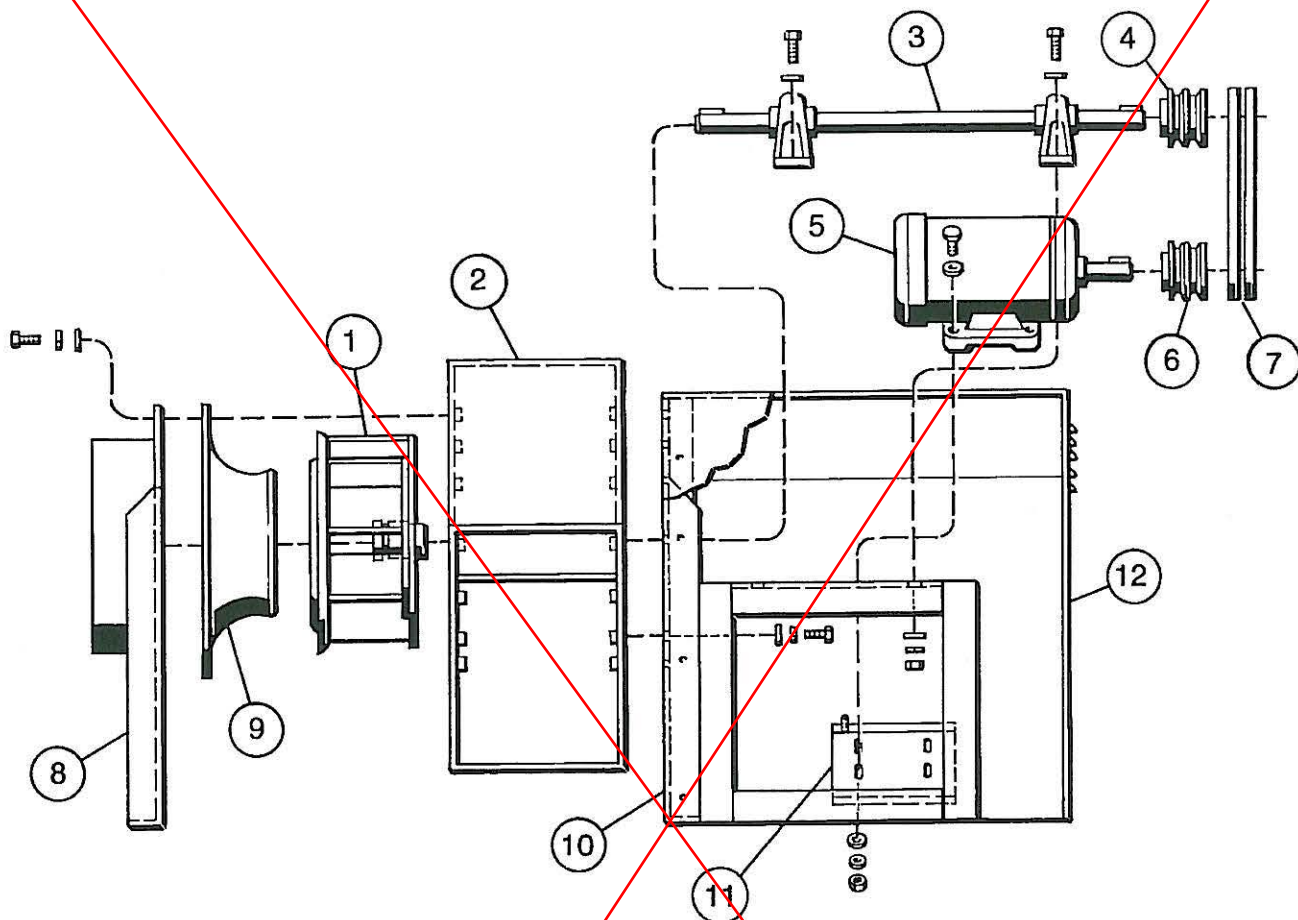
\* Motor not shown in figure

**MODELS HDBI, HDAF and RBE**  
**Arrangement 9CB Channel Base**



1. Housing
2. Shaft and bearing assembly
3. Fan shaft pulley
4. Belt(s)
5. Base, fan
6. Motor shaft pulley
7. Motor
8. Inlet side plate
9. Inlet bell (on Models HDBI and HDAF only)
10. Wheel (HDBI wheel shown)
11. Motor slide base
12. Belt guard
13. Base, Channel

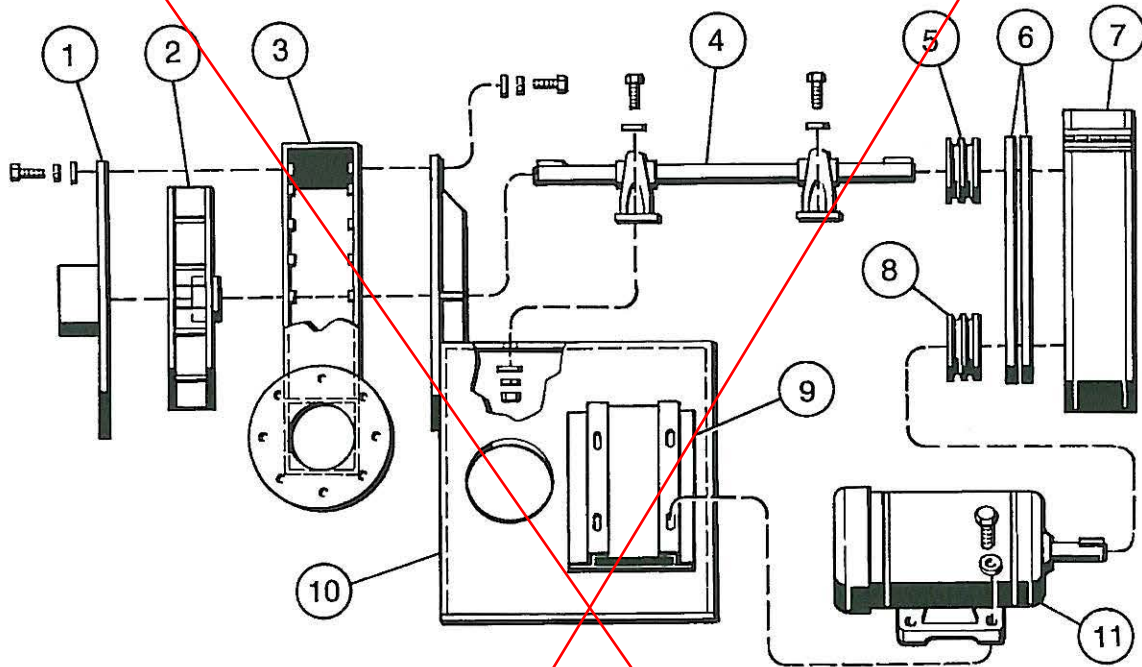
MODELS HDBI, HDAF and RBE  
Arrangement 10



1. Wheel (HDBI wheel shown)
2. Housing
3. Shaft and bearing assembly
4. Fan shaft pulley
5. Motor
6. Motor shaft pulley
7. Belt(s)
8. Inlet side plate
9. Inlet bell (on Models HDBI and HDAF only)
10. Base, fan
11. Motor base
12. Weather cover



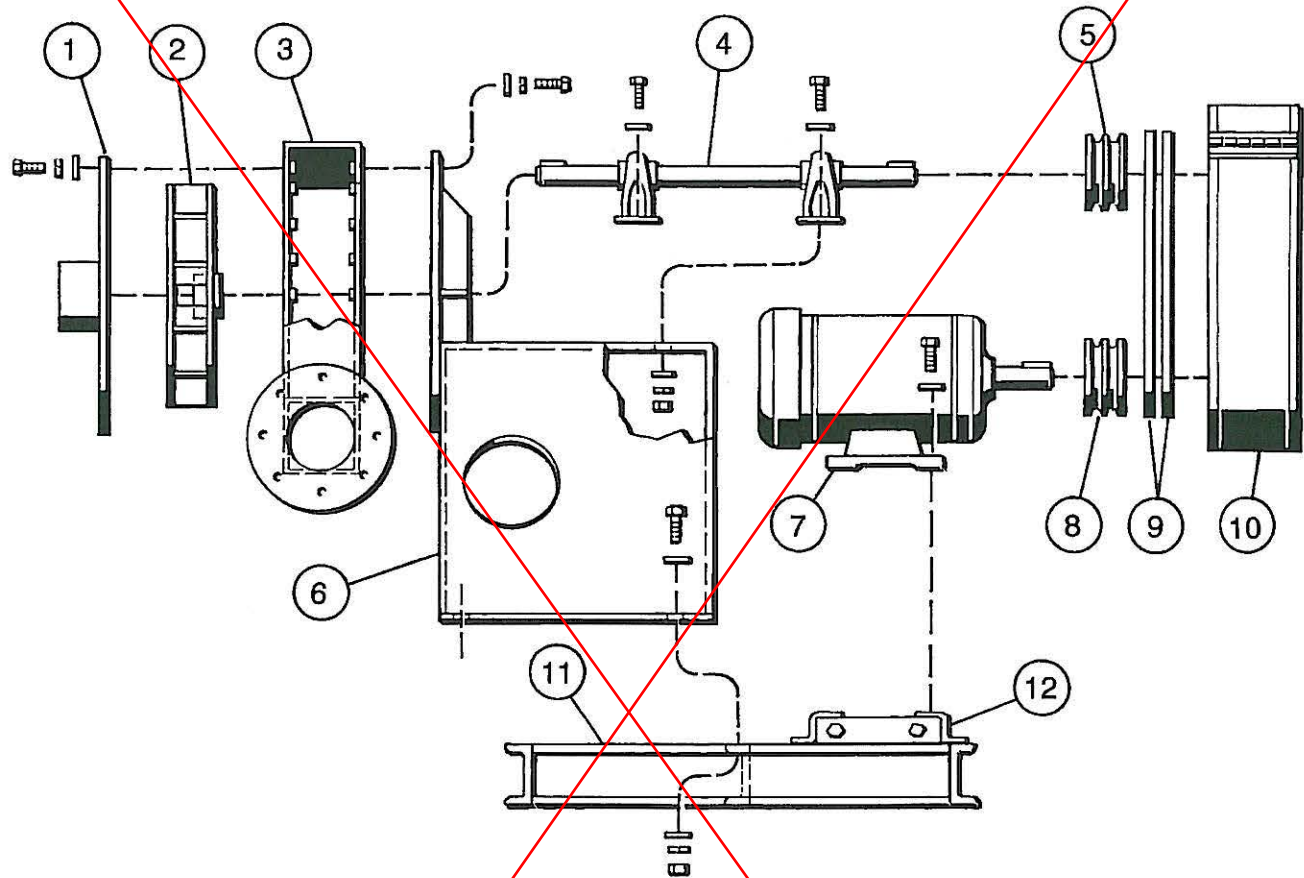
**MODEL HP**  
**Arrangement 1 and 9**



1. Inlet side plate
2. Wheel
3. Housing
4. Shaft and bearing assembly
5. Fan shaft pulley (Arr. 9 only)
6. Belt(s) (Arr. 9 only)
7. Belt guard (Arr. 9 only)
8. Motor shaft pulley (Arr. 9 only)
9. Motor side base (Arr. 9 only)
10. Base, fan
11. Motor (Arr. 9 only)

NOTE: Shaft seal is not shown

**MODEL HP**  
**Arrangement 9CB Channel Base**



1. Inlet side plate
2. Wheel
3. Housing
4. Shaft and bearing assembly
5. Fan shaft pulley
6. Base, fan
7. Motor
8. Motor shaft pulley
9. Belt(s)
10. Belt guard
11. Base, channel
12. Motor side base

Note: Shaft seal is not shown.

# EXHAUST FAN M-12-19-1 MOTOR



No.:

Date: 20-MAR-2017

## DATA SHEET

### Three-phase induction motor - Squirrel cage rotor

Customer :  
Product line : Explosion Proof - NEMA Premium

Frame : 182T  
Output : 3 HP  
Frequency : 60 Hz  
Poles : 2  
Full load speed : 3510 rpm  
Slip : 2.50 %  
Voltage : 208-230/460 V  
Rated current : 8.32-7.52/3.76 A  
Locked rotor current : 63.2/31.6 A  
Locked rotor current (I<sub>L</sub>/I<sub>n</sub>) : 8.4  
No-load current : 2.80/1.40 A  
Full load torque : 4.43 lb.ft  
Locked rotor torque : 250 %  
Breakdown torque : 400 %  
Design : B  
Insulation class : F  
Temperature rise : 80 K  
Locked rotor time : 30 s (hot)  
Service factor : 1.15  
Duty cycle : S1  
Ambient temperature : -20°C - +40°C  
Altitude : 1000 m  
Degree of Protection : IP55  
Approximate weight : 90 lb  
Moment of inertia : 0.14713 sq.ft.lb  
Noise level : 69 dB(A)

	D.E.	N.D.E.
Bearings	6307 2RS	6206 2RS
Regreasing interval	---	---
Grease amount	---	---

Load	Power factor	Efficiency (%)
100%	0.85	86.5
75%	0.81	85.5
50%	0.73	82.5

Notes:

Performed by

Checked

# EXHAUST FAN M-12-19-1 MOTOR

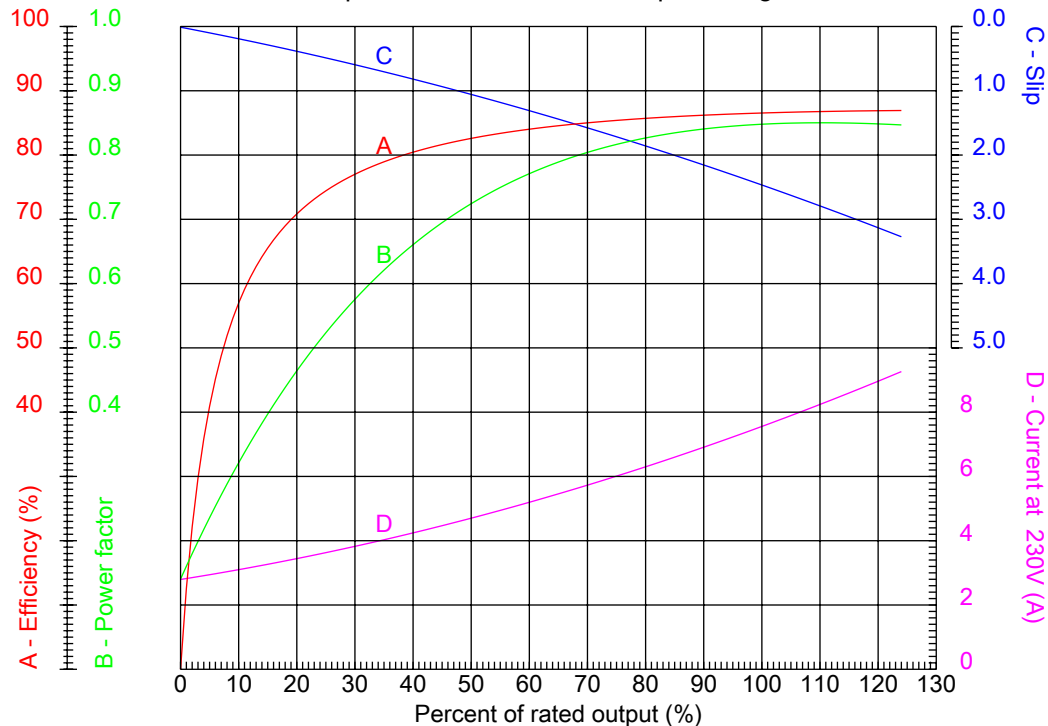


No.:

Date: 20-MAR-2017

## PERFORMANCE CURVES RELATED TO RATED OUTPUT

Three-phase induction motor - Squirrel cage rotor



Customer :  
Product line : TEFC - Explosion Proof - NEMA Premium Efficiency

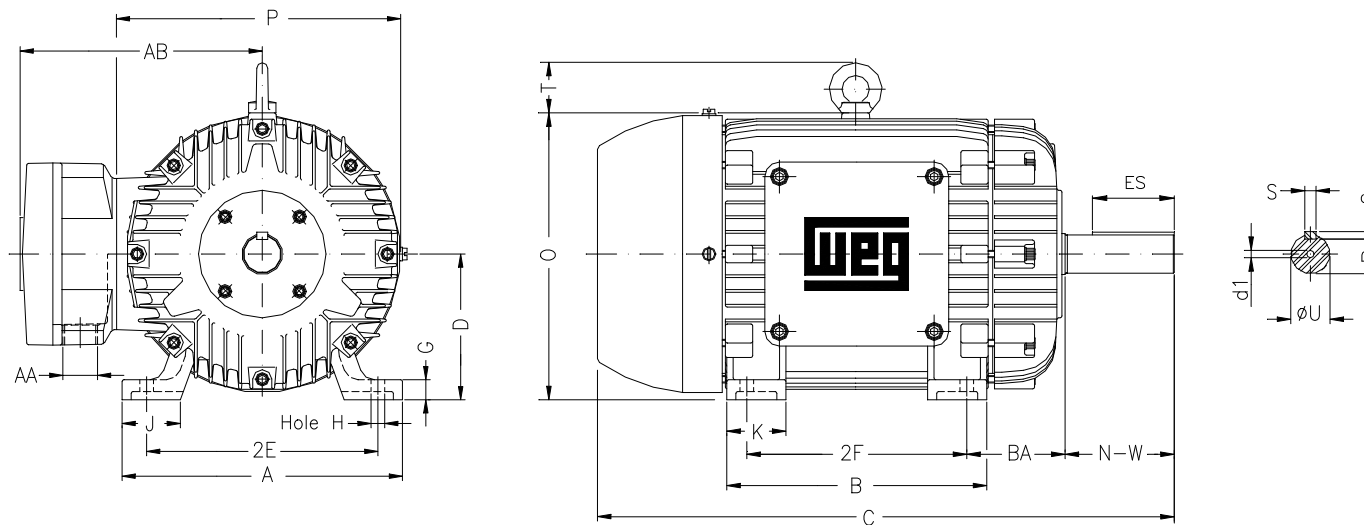
Frame	: 182T	Locked rotor current (I <sub>L</sub> /I <sub>n</sub> )	: 8.4
Output	: 3 HP	Duty cycle	: S1
Frequency	: 60 Hz	Service factor	: 1.15
Full load speed	: 3510 rpm	Design	: B
Voltage	: 208-230/460 V	Locked rotor torque	: 250 %
Rated current	: 8.32-7.52/3.76 A	Breakdown torque	: 400 %
Insulation class	: F		

Notes:

Performed by

Checked

# EXHAUST FAN M-12-19-1 MOTOR



Notes:

Performed by:

Checked:

Customer:

TEFC - Explosion Proof - NEMA Premium Efficiency

Three-phase induction motor

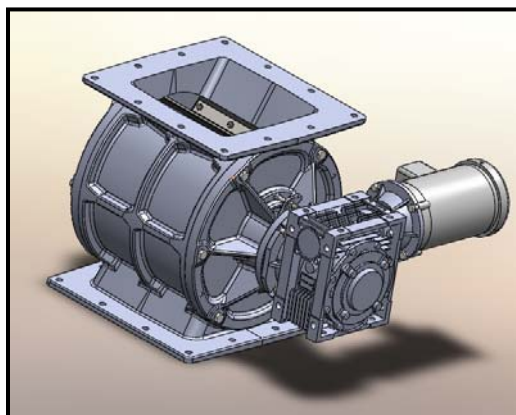
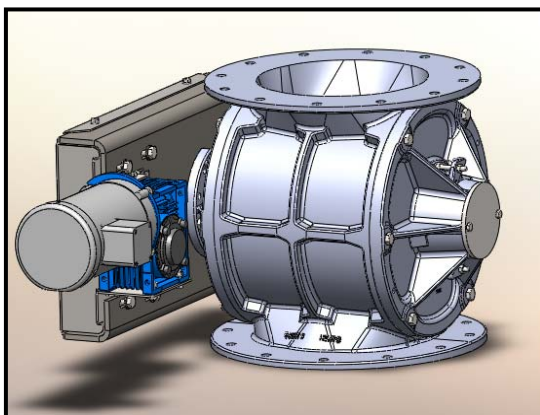
Frame 182T - IP55

20-MAR-2017



# INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS

## UDV & DDV Series Rotary Airlock Feeders



Your Source for Bulk Handling/Air Process Equipment

**Wm. W. Meyer & Sons, Inc.**

1700 Franklin Boulevard • Libertyville, Illinois 60048 • 847-918-0111 • Fax: 847-918-8183

e-mail: [sales@wmwmeyer.com](mailto:sales@wmwmeyer.com) • website: [www.wmwmeyer.com](http://www.wmwmeyer.com)

295-K-001

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### SAFETY PRECAUTIONS

WARNING: TO OWNER, AND INSTALLATION, OPERATION AND MAINTENANCE PERSONNEL



The safety of the operator and those people that may come into contact with the Rotary Airlock Feeder Valves ("Equipment") is of great importance to Wm. W. Meyer & Sons, Inc ("Meyer"). The decals, shields, guards or other protective features furnished or recommended for this machine are there for your protection. BEFORE attempting to install, operate or perform maintenance on this Equipment READ carefully and UNDERSTAND all safety instructions contained in this ***Installation, Operation, and Maintenance Instructions*** ("***Instructions***"). Manuals are available in some additional languages.

Operation, Installation and Maintenance personnel should READ carefully and UNDERSTAND the sections of this ***Installation, Operation and Maintenance Instructions*** relevant to the work they are performing.

The various precautions and recommendations detailed within this manual are not necessarily all inclusive. These Instructions are intended to provide general safety and operation guidance relating to typical installations with which Meyer is familiar.

Additional information may be provided that pertain to your specific installation, upon request. Equipment owners are responsible for understanding the contents of this document and compliance with applicable government laws and regulations and appropriate industrial standards. Appropriate plant safety and Equipment training is the responsibility of the plant owner. This Manual is intended to assist the owner in the training process. The operation, installation and maintenance of this Equipment should be restricted to only those personnel properly trained:

- Installation and maintenance of equipment must be performed by qualified mechanics/millwrights/maintenance personnel.
- Installation of any electrical equipment must be completed by qualified electricians, in compliance with applicable codes and ordinances.
- Operation should be performed by personnel trained to operate the rotary airlock feeders and related process equipment.

Because Wm. W. Meyer & Sons ("Meyer") is not always aware of the application and is not involved with the installation, your participation in the safe installation, operation and maintenance of this Equipment is critically important. Meyer would be pleased to supply qualified personnel to assist on-site. To obtain a quotation for field service or if you have any safety, installation, operation, maintenance or other Equipment-related questions we encourage you to contact the Meyer factory at (800) 963-4458.





**Always CONTROL / DE-ENERGIZE potentially hazardous energy sources when installing and maintaining the Equipment, as follows:**

1. The Rotary Airlock Feeder product family uses a common mechanical principle which creates an internal pinch point in order to function properly: a metal rotor with blades rotates around an axis within a metal housing.
  - a. This Equipment should **never be maintained or operated in a manner which could expose personnel to the internal moving parts**; either via the inlet/discharge port, an access door of any kind or via ancillary equipment affixed to the rotary airlock feeder. **To do so will expose personnel to the potential risk of serious injury.**
  - b. Avoid serious injury by **always** keeping hands, fingers, feet, etc., loose clothing, and foreign objects away from inlet and discharge openings, drive components, auxiliary components, and associated equipment.
2. **Always de-energize all electrical equipment by Locking Out/Tagging Out power** before working on this Equipment, including motors, switches, solenoids and other ancillary electrically powered or controlled Equipment. If the electrical components are not properly de-energized, this will expose personnel to the potential risk of serious injury. **WARNING!** This Equipment may stop and start automatically, and may also operate very quietly. Equipment in an idle mode does not mean it is off-line.
3. Inlet and Outlet flanges must **always** be permanently fastened to mating system components. Such components must be designed so that under normal operation personnel are neither allowed access to the inlet or outlet flange nor able reach the internal moving parts. If requested, Meyer can design, build and supply custom ductwork, transition pieces, piping or special guards to protect against the risk of injury.
4. Rotary airlock feeders, their drive components, accessory components, and any auxiliary or companion equipment, should be installed and operated only with protective guards correctly and securely fastened in place.
5. Never open access covers/doors to inspect the Equipment when the overall plant system is under process pressure. Wait for process pressures to be relieved (i.e. ambient pressure is confirmed).
6. If working on the Equipment when the Equipment surface is hot, always wear appropriate protective clothing (e.g. gloves and other protective outer clothing), or if hot surfaces could burn skin, wait for surfaces to cool before performing work which could put someone in a hazardous situation.
7. All process material should be removed from within the equipment before working on any internal components. Process material may be hot, corrosive, or otherwise hazardous or the material could otherwise lead to injury when working on the internal components. To clear material, before de-energizing the rotary airlock feeder, isolate

the rotary airlock feeder from material above the rotary airlock feeder and cycle the rotary airlock feeders until all process material has passed through the rotary airlock feeder. Note, some materials may stick to internal components. If working on the internal components, make sure these materials are reasonably removed before working on the internal components, after the equipment has been properly locked out /tagged out and gas pressure relieved per plant safety requirements. Wear appropriate protective clothing and protective personnel gear (gloves, long sleeve shirts, breathing protection, eye protection, etc.).

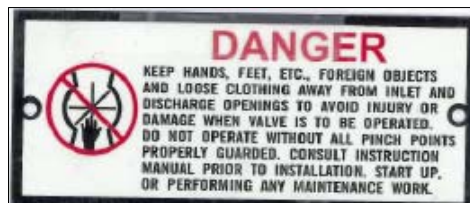
8. The weight of a rotary airlock feeder or its components parts, such as the rotor, headplates, etc., can cause serious injury or damage if accidentally dropped or mishandled during assembly, disassembly and installation. Use safe and acceptable methods when handling this equipment. Contact the factory for recommended safe handling and rigging techniques.
9. Refer also to appropriate supporting vendor safety information in addition to these Instructions.

### SAFETY LABELING

The precautionary labels shown below are affixed to your Equipment and/or are enclosed in a Safety Supplement packed with your Equipment at the time of shipment. These Safety Supplement label packs are supplied for the system installer's or plant owner's discretionary use/placement to ensure this Equipment is installed, operated and maintained in the safest possible manner.

**CAUTION:** If you have received a unit without affixed or supplementary labels or if labels fall off or are damaged, contact Wm. W. Meyer & Sons immediately (800-963-4458) to obtain replacements prior to installation, use or maintenance.

#### Access Warning Label (Metal Tag Affixed to Housing)



#### Moving Parts Label



#### Lock Out Power Label



### Keep Hands Clear Label



### Do Not Operate Without Guards Label (UDV Only)



### Automatic Remote Start Label



Meyer ships the Equipment with labels located on the drive guards, drive bases (when included: no drive guards or bases are included on DDV Airlock Feeders, as they are directly driven), the rotary airlock feeder housing and other surfaces. However, as the orientation of the Equipment varies, the OWNER is responsible for affixing any supplementary labels to allow safety label visibility to be maximized. The following recommendations are offered to assist placement of safety labels:

- Place labels in locations that all personnel operating and maintaining the Equipment or any other people that may have access to the Equipment will readily see as they are either working on the Equipment and/or as they approach the Equipment. The safety objective is for anyone who could come in contact with a hazard sees the label alerting him or her to such a hazard and the means to avoid the hazard.
- In some cases, labels may be located near the Equipment (e.g. on nearby structural steel, adjacent equipment), if this is the point of access where it can be easily seen and the hazard is clearly associated with the label's location and how it relates to the Equipment.
- For some applications, the Equipment is operated at elevated temperatures. Standard labels (stickers) will not survive the high temperatures. Special labeling materials and mounting procedures may be required. This may consist of stainless steel labels, which may require special mounting or a mounting location near but not on the equipment.

### INFORMATION FOR SAFETY AND SERVICE

Because of the wide variety of material handling systems for which a RAL feeder must be tailored, many considerations determine the proper size, design, materials of construction, operating speed, type of driver, etc. A description of every Meyer RAL is kept on file with the factory. These specifications can be referenced by supplying the serial number to your local Meyer Representative. If you have any safety or Equipment-related questions we encourage you to contact the Meyer factory based on the cover contact information.

NOTE: The serial number is located on a metal identification label permanently affixed to every RAL feeder before it leaves the factory. To aid us in providing you with a special service, application assistance and help with spare part requirements, please record the following:

Type/Size \_\_\_\_\_  
Serial Number \_\_\_\_\_  
Date of Installation \_\_\_\_\_

## APPLICATION OF ROTARY AIRLOCK FEEDERS

### A. Application

Meyer Rotary Airlock Feeders (also called Rotary Valves) are used in pneumatic conveying systems, dust control equipment, and as volumetric feed-controls to maintain an even flow of material through processing systems.

The basic use of the rotary airlock feeder is as an airlock transition point, sealing pressurized systems against loss of air or gas while maintaining a flow of material between components with different pressure. Rotary Airlock Feeders are also widely used as volumetric feeders for metering materials at precise flow rates from bins, hoppers or silos into conveying or processing systems.

Rotary Airlock Feeders have wide application in industry wherever dry free-flowing powders, granules, crystals, or pellets are used. Typical materials include: cement, sugar, minerals, grains, plastics, dust, fly ash, flour, gypsum, lime, coffee, cereals, pharmaceuticals, etc.

### B. Operational Specifications

Table capacities are in Cubic Feet Per minute. CFR = Cubic Feet per Revolution

(Based on 8 Vane open end rotor and 100% fill factor)

Size	8V	Revolutions Per Minute			
	CFR	15	20	22	25
6" UDV / DDV	0.10	1.5	2.0	2.2	2.5
8" UDV / DDV	0.24	3.6	4.8	5.2	6.0
10" UDV / DDV	0.50	7.4	9.9	10.9	12.4
12" UDV / DDV	0.91	13.7	18.2	20.1	22.8
14" UDV / DDV	1.41	21.1	28.2	31.0	35.2

### C. Models

There are (2) models of Meyer Rotary Airlock (RAL) Feeders in this series:

1. UDV ("Universal Duty Valve") Rotary Airlock Feeders
2. DDV ("Dust Duty Valves") Rotary Airlock Feeders

UDV & DDV RAL Feeders utilize sealed outboard-mounted ball bearings and split packing gland design with individual packing rings.

The UDV and DDV differ mainly in their drive configuration and the number of options available. The UDV uses a chain drive while the DDV has a direct drive mounted on one headplate.

The DDV is provided with a standard 22 RPM direct drive and motor with either beveled rotor or urethane seal strip rotor.

The UDV comes standard in 15, 20 and 25 RPM chain driven rotor speeds, with gear reducer and motor with either beveled rotor or various seal strip rotor. Seal strips may be provided in a variety of rigid and flexible styles.

---

## INSTALLATION

### A. RECEIVING AND INSPECTION

Upon receipt of equipment and material from Wm. W. Meyer & Sons, Inc., the following basic steps should be taken:

1. Use the packing list to determine that all the items shipped have been received. Your equipment was carefully crated for safe shipment when given to the carrier. If items are missing, contact Wm. W. Meyer & Sons, Inc., per contact information at the end of this section.
2. Check for damage. Damage in transit is the responsibility of the carrier. Title to your machine and all other items in the shipment were transferred to you as soon as the shipment left our dock, thus it is your responsibility to handle any claim. In the event damage has occurred:
  - a. Be sure to have the driver sign a copy of the freight bill with a notation about any damage and contact their office before the driver leaves your premises.
  - b. Contact the truck line to arrange for an independent inspector to come out to inspect the damage and to prepare the inspection report. *It is imperative that this inspection is done before you start to unpack or use any of the equipment.*
  - c. If there are any visible problems with your machine or any other items in the shipment, you or the driver must note in detail the damage on all copies of the freight bill before signing for the shipment. Then immediately call Wm. W. Meyer & Sons, Inc.
  - d. If helpful, photographic records of the damage may be used to communicate the extent and type of damage as well as provide a clear record.

- e. If a shipment was sent to you by parcel post, have the postmaster complete a damage claim report.
- f. Concealed Damage: If Equipment or goods are discovered to be damaged in shipment at a later date, contact the carrier and Wm. W. Meyer & Sons, Inc., immediately.
- g. In all cases of damage in transit, contact Wm. W. Meyer & Sons, Inc., for assistance in determining whether or not this damage may in any way affect safety or proper operation. Please contact us so that we can assist you with replacement parts or with any questions about the claim process, using the following contact information:

Wm. W. Meyer & Sons, Inc.  
1700 Franklin Blvd  
Libertyville, IL 60048

847-918-0111  
sales@wmwmeyer.com

### **B. STORING THE ROTARY VALVE**

1. Short Term Storage (Up to a few weeks)
  - a. If moved to storage, the equipment should be located in a dry area, preferably inside. Outside storage will require adequate protection from the weather.
  - b. The inlet and outlet of the rotary valve should be securely covered to protect the interior while in storage. For prolonged storage an anti-rust compound should be applied to all interior surfaces. See motor and reducer data for storage rules.
  - c. After storage and prior to start-up, the rotary valve and its drive train should be inspected by qualified personnel.
2. Long Term Storage
  - a. Spray the interior of the valve with anti-rust preservative oil.
  - b. Provide and install metal covers for inlet and outlet flanges with at least four capscrews in each flange. Keep covers on unit until ready for service.
  - c. Read and follow motor, speed reducer, and other equipment manufacturer's instructions for long term storage.
  - d. Plug all conduit box openings on motors and switches.
  - e. Store off the floor in a dry, adequately ventilated, indoor area not subject to extreme temperature changes. These requirements are minimum.
  - f. If stored for more than 6 months, turn the rotor a couple of revolutions every six months. Leave the rotor in a different angular position after turning.

### 3. Placing In Service After Long Term Storage

- a. Drain and re-fill worm gear speed reducer with appropriate lubricant to proper level. Replace solid plug in fill opening with vented unit. Review speed reducer manufacturer's instructions for additional requirements.
- b. Follow motor manufacturer's instructions for removing motor from storage.
- c. Clean preservative oil from interior of valve.

### C. MOUNTING

1. Prior to installing the valve and with the power disconnected, check to assure no foreign objects have been left inside or have accidentally fallen into the valve.
2. We recommend that inlet and outlet flanges remain covered until the valve is ready to be attached to the mating equipment.
3. Rotary Valves must be installed with the top and bottom flanges parallel to the mating system flanges and adequately supported to prevent distortion.

**CAUTION** - Never operate a rotary valve unless the inlet and outlet openings are protected with temporary flange covers, the connecting equipment or approved guards. Contact Wm. W. Meyer & Sons, Inc. for flange guards if flanges are open during operation.

### D. ELECTRICAL CONNECTION

1. Check for correct rotation by "bumping" motor. Unless specified otherwise, Meyer rotary airlock valves operate in the clockwise direction as viewed from the drive end.

**DANGER** - Disconnect power before servicing motor or drive components else serious personal injury may occur.

2. When safety switches are supplied, they must be interlocked to provide adequate personnel protection. Safety switches are an extra cost option available for any rotary valve where its particular operating condition may warrant the use of switches to improve the safe operation of the valve. We urge each customer to review each rotary valve installation for this safety switch consideration. If furnished, never manually override or electrically by-pass any protective device. Contact Wm. W. Meyer & Sons, Inc., for assistance in reviewing your particular rotary valve installation. Also contact your plant safety director and ask for a review of the rotary valve installation with regard to safety.



### START-UP PROCEDURE

1. Prior to actual operation, the operator must familiarize himself with the method of starting and stopping the Rotary Valve, and the status of supporting utilities.
2. The general appearance of the Rotary Valve and surrounding area should be visually inspected to determine that the valve can be operated safely and without causing any type of damage.
3. Assure that the speed reducer has been filled to the correct oil level with the appropriate lubricant as recommended by the manufacturer. Lubrication instructions were included with the rotary valve.
4. "Bump" the unit with the motor starter to check for correct rotation. Change the phase sequence to the motor if rotation is wrong. Always assure the unit is properly grounded in accordance with OSHA, the NEC and local codes.
5. Start the unit again, noting any unusual noise or vibration. If noise is evident it is recommended that the equipment be shut down and re-inspected for foreign materials. If no obstruction appears you should contact Meyer before any further operation. Assure motor amperage does not exceed name-plated value.
6. Guards should be in place and closed securely whenever the rotor is turning.

**CAUTION:** Whenever access to rotating components is required (e.g. for cleaning or servicing), always de-energize electrical equipment in accordance with plant operating procedures and lock-out/tag-out procedures. De-energize any compressed gas sources and any auxiliary equipment before the work is started. If Equipment is hot, either wait until it cools or wear appropriate protective clothing when working on the Equipment.

7. After the initial operating period, we recommend that your plant engineering and maintenance personnel continue to monitor the operation of the valve on a regular schedule. Particular attention should be paid to the following items:

**a. Speed Reducer**

The standard gearbox is filled with synthetic oil and is sealed for life, but optional gearboxes may contain oil drain, fill and level plugs. If so equipped check for proper lubrication. Monitor gearbox during startup for excessive heat, vibration or unusual noise which may indicate a problem with the speed reducer.

**b. Bearings**

The condition of rotary valve bearings should be checked routinely. Excessive heat, vibration, or unusual noise indicates a potential problem.

**c. Seals**

The type of seal depends on the model and options of your Meyer Rotary Airlock. Maintenance is limited to replacement of the seal or packing when the wear and leakage becomes excessive.

### **d. Drive**

The drive should run smoothly with minimal vibration. If the unit is jumping or shaking check for proper chain tension and chain alignment. If the problem persists consult Meyer for an application review. The clipping that can result from certain kinds of materials can destroy a rotary valve in short order.

### **GENERAL INSPECTION**

1. Observe equipment for any unusual vibration, noise or operating temperatures in excess of the maximum specified for your installation.
  2. Check valve flange and purge connections, and all nuts/capscrews for tightness.
  3. Be alert to oil leaks on machinery and around the surrounding area.
  4. Inspect inlet and outlet fittings, flanges and ducts for leaks. Check utility service piping and associated valves and gauges attached to the Rotary Valve.
  5. Check all accessories for proper operation. Check safety switches for adjustment, and operating mechanism for alignment.
- 

## **PROPER CARE AND HANDLING**

The Meyer rotary airlock feeder has been manufactured from the finest materials available and to exacting standards of workmanship. Very close and precise tolerances assure the best possible fit and seal between all components. As with any quality product, they should be given proper handling and care, as outlined below:

1. Never switch a rotor from within one housing into another without contacting the Meyer factory. Due to temperature and application considerations not all parts are interchangeable. Some housings and rotors are "mated".
2. Use special care and handling to avoid spoiling (i.e., nicking, scoring, gouging, galling, etc.) any internal surface, edge or contour of the housing, rotor or endplate. Any degradation of these machined surfaces may upset the internal clearances, cause the valve to bind and cause extensive damage.
3. Rotary airlocks of cast iron construction without any special purpose surface coating (such as electro-less nickel) are subject to rust and corrosion when exposed to moisture. If water is used as a cleansing agent, be sure valve is completely dry and rotor is free to turn before returning to service.

4. Sealed and pre-lubricated bearings are normally supplied with the rotary airlock. If the rotary valve components are to be submerged in a cleaning tank or similar type of bath, the bearings must first be removed from the headplate.
5. Always clean and inspect one valve at a time and reassemble immediately to avoid mismatching parts.

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## MAINTENANCE

**DANGER** – Before beginning any work on the rotary valve, make sure that the incoming power to the gearbox / motor is LOCKED OFF.

### A. LUBRICATION

#### 1. Speed Reducer

Standard models utilize a right angle worm gear type. Lubricant instructions published by the particular reducer manufacturer are included with the rotary valve.

#### 2. Bearings

Rotary airlock feeders manufactured with ball bearings utilize pre-lubricated, sealed, anti-friction ball bearings that do not require regreasing.

#### 3. Seals/Packing Gland

UDV and DDV use a split packing gland nut design which allows the packing gland nuts to be removed from the valve for ease of service. UDV and DDV Feeders are supplied with aramid fiber packing within the packing gland housing. UDV may be supplied with higher temperature seal materials if the application requires.

Gas Purge or Grease Purge seals are available as an option on UDV Feeders. When gas (most commonly air) purge is selected, a lantern ring is supplied inboard of the packing rings. Compressed gas is introduced to the lantern ring through a drilled hole in the headplate. Optional filter- regulator- lubricator and/or solenoid valve is available to control the gas pressure and flow into the airlock. The gas should be turned on before the valve is started and turned off after the valve is stopped to insure that dust does not enter the lantern ring. Gas pressure should be 10-15 psi above the valve operating pressure.

When grease purge is selected, a lantern ring is sandwiched between two rows of packing. Grease is introduced to the lantern ring through a drilled hole in the headplate. A Lithium Base NLGI #2 grease or equivalent may be used for lubrication. Higher temperature-rated greases may be required when the product temperature exceeds 275 Deg F.

### 4. Chain

The roller chain furnished with standard feeders is pre-lubricated at the factory. The chain should be oiled periodically with a brush or spout can every 50 hours of operation. A good grade of non-detergent petroleum base oil should be used with the viscosity shown below:

Ambient Temperature(Deg F)	Lubricant
20-40	SAE 20
40-100	SAE 30
100-120	SAE 40
120-140	SAE 50

### B. PACKING SEALS

The packing may be replaced in Meyer UDV Rotary Airlock Feeders without removing the feeder from the installation.

1. Remove packing gland stud nuts that push on the packing gland nuts to compress the packing.
2. Loosen jam nuts holding studs, back out studs, remove jam nuts and then remove studs.
3. Remove packing gland nuts through headplate openings.
4. Remove packing with packing hook.
5. Install new packing.
6. Push packing gland nut into packing carrier.
7. Replace and carefully tighten gland nut stud nuts to compress packing, but not to the extent that excessive drag is forced on the shaft or that the packing is crushed.
8. If your airlock is equipped with a grease purge, for each headplate the bearing and lantern ring must be removed to replace the innermost packing ring (refer to disassembly procedures below).

### C. SEAL STRIP REPLACEMENT

**DANGER** – Before beginning any work on the rotary valve, make sure to disconnect and lockout all electrical power sources to motor, making sure to de-energize beforehand incoming power to the gearbox motor is LOCKED OFF.

1. Remove the feeder from the installation or gain access to the top and bottom of the feeder.
2. For UDV models, remove the drive base and then remove the master link and chain.
3. For DDV models, remove the gear reducer and motor, as described under Disassembly Section.

*NOTICE: Flexible seal strips, such as Neoprene and Urethane, are installed on the **trailing** edge of the rotor blades. Rigid seal strips, such as Teflon, brass, and steel, are installed on the **leading** edge of the rotor blade. New strips should be installed in the same location. Incorrect installation may lead to damage to the seal strips and the incorrect operation of the rotary airlock feeder.*

*To replace flexible seal strips:*

1. Turn the rotor in a clockwise direction (facing the drive end) until one seal is completely clear.
2. Unbolt the seal strip holder and remove the old seal strip.
3. After brushing off the loose material from the tip of the rotor and behind the old seal, fit in the new seal strip. The **flexible** seal strips have slots so that the new seal strip may be placed as high as possible on the rotor. The flexible seal strip should be slightly above the feeder inlet so that it will curve back from the direction of rotation. Install seal strip holder and turn down capscrews finger tight. Tighten all screws with wrench.
4. Advance the rotor to the next position either by turning the feeder sprocket by hand, or by placing a pipe wrench on the sprocket hub. Do not use a pipe wrench on the rotor shaft.
5. You will note that the feeder will become progressively harder to turn with the installation of each new flexible seal, but this tightness is a must if the feeder is to have an air tight seal. A few drops of oil on each seal will reduce the friction and allow the rotor to be turned easier.

*To replace rigid seal strips:*

1. Turn the rotor in a clockwise direction (facing the drive end) until one seal is completely clear.
2. Unbolt the seal strip and remove the old seal strip.
3. After brushing off the loose material from the tip of the rotor and behind the old seal, fit in the new seal strip. **Rigid** seal strips should be installed with proper design clearance.
4. Install seal strip and turn down capscrews finger tight. Tighten all screws with wrench.
5. Advance the rotor to the next position either by turning the feeder sprocket by hand, or by placing a pipe wrench on the sprocket hub. Do not use a pipe wrench on the rotor shaft.
6. The best way to reset/replace **rigid** seal strips is to remove the rotor completely from the housing, replace or move the seal strips out beyond the housing inside diameter,

and then machine the rotor to design diameter and length. Attempting to adjust rigid seal strips inside the airlock will achieve a marginal result at best.

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### DISASSEMBLY PROCEDURES

Follow the procedure appropriate to your valve model.



#### A. UDV RAL DISASSEMBLY PROCEDURE

*(See views of feeder on pages 24 and 25 to identify item numbers shown in parentheses)*

**DANGER** – Before beginning any work on the rotary valve, make sure to de-energize all power sources to the rotary airlock and make certain the power to the motor is LOCKED OUT.

#### DISASSEMBLY

To remove the UDV rotor (4) from the valve housing (1), follow these steps:

1. Remove the guard front cover (37).
2. Remove the master link and chain (35 & 36).
3. Remove the sprockets (31 & 32).
4. Remove the fasteners holding the speed reducer (12, 20, 21 & 22), brackets (18 & 23) and spacers (19) to the drive base (17) and remove the gearbox (25) and motor (28). Disconnect electrical power to motor, making sure to de-energize and lockout all power sources beforehand. Support the gearbox and motor before removing the fasteners. Alternatively, you may remove the motor first and then the speed reducer, by unbolting the motor mounting bolts.
5. Remove the drive base plate by removing the fasteners holding it to the drive end headplate (20 & 24). Remove the wave spring (16).
6. Remove the blind end bearing cap (14).
7. Unscrew (counter-clockwise) the associated **blind end** headplate capscrews (12).
8. Slowly pull the blind end headplate (3) straight away from the housing (1). This requires the use of a bearing puller, as the bearings are a press fit on the shaft. The jaws of the puller should be mounted on the headplate at the inboard side of the bearing chamber and the threaded rod/ single point end should be mounted on the end of the shaft. Avoid pulling the headplate off in an uneven “side to side” manner. Mishandling can cause damage to the seal. The bearing (13) will remain in the headplate and slide off of the shaft.
9. Unscrew (counter-clockwise) the associated **drive end** headplate capscrews (12).
10. Repeat the process in Step 8 for the drive end headplate (2).
11. Remove the rotor from the housing by gripping the end of the shaft. Be prepared to support the weight of the rotor as it is removed from the housing. Slowly and evenly

pull the rotor straight out from the housing. Be careful to avoid striking the housing bore with any edge of the rotor or dropping the rotor. Caution: the rotor blades may be sharp.

12. The rotor as well as interior of the housing is now open and exposed for cleaning and inspection.

To remove the bearings (13), seal assemblies (5, 6, 7, 8 & 9) and where applicable, lantern rings, from the headplates (2 or 3), follow these steps:

1. The bearing is clearance fit in its headplate. Press the bearing out of the headplate in an outboard direction.
2. Press the seals (5) and lantern ring (if any) from each headplate if removal is desired.
3. The headplates are now ready for inspection and cleaning.

### B. DDV RAL DISASSEMBLY PROCEDURE

*(See views of feeder on pages 26 & 27 to identify item numbers shown in parentheses)*

**DANGER** – Before beginning any work on the rotary valve, make sure to de-energize all power sources to the rotary airlock and make certain the power to the motor is LOCKED OUT.

### DISASSEMBLY

To remove the DDV rotor (4) from the valve housing (1), follow these steps:

1. Remove the fasteners holding the speed reducer (20& 21) and motor and slide the gearbox and motor off from the rotor shaft. Support the gearbox and motor before removing the fasteners. Disconnect electrical power to motor, making sure to de-energize and lockout all power sources beforehand. Alternatively, you may remove the motor first and then the speed reducer, by unbolting the motor mounting bolts.
2. Remove the bearing retainer (17) and wave spring (16).
3. Remove the blind-end bearing cap (14).
4. Unscrew (counter-clockwise) the associated **blind end** headplate capscrews (12)
5. Slowly pull the blind end headplate (3) straight away from the housing (1). This requires the use of a bearing puller, as the bearings are a press fit on the shaft. The jaws of the puller should be mounted on the headplate at the inboard side of the bearing chamber and the threaded rod/ single point end should be mounted on the end of the shaft. Avoid pulling the headplate off in an uneven “side to side” manner. Mishandling can cause damage to the seal. The bearing (13) will remain in the headplate and slide off of the shaft.
6. Unscrew (counter-clockwise) the associated **drive end** headplate capscrews (12).
7. Repeat the process in Step 5 for the drive end headplate (2).

8. Remove the rotor from the housing by gripping the end of the shaft. Be prepared to support the weight of the rotor as it is removed from the housing. Slowly and evenly pull the rotor straight out from the housing and out of the other bearing. Be careful to avoid striking the housing bore with any edge of the rotor or dropping the rotor. Use caution as the rotor blades may be sharp.
9. The rotor as well as interior of the housing is now open and exposed for cleaning and inspection.

To remove the bearing (17), packing seals (5) and where applicable, lantern ring, from the headplate (2 or 3), follow these steps:

1. Press the bearing out of the headplate in an outboard direction.
2. Press the seals (5) and lantern ring (if any) from each headplate if removal is desired.
3. The headplates are now ready for inspection and cleaning.

## REASSEMBLY PROCEDURES

Follow the procedure appropriate to your valve model.

Some things to know when assembling UDV or DDV Feeders:

- *The headplate-to-housing pins will locate the rotor in the center of the housing, setting radial clearances, once the rotor is installed.*
- *The process of assembly is most easily accomplished by building the feeder vertically, meaning you will need a secure stand into which the rotor will fit and not be obstructed on the bottom end. The feeder can also be assembled horizontally. The instructions below apply the vertical assembly approach.*
- *The bearings have a slight interference fit between their inner diameters and the corresponding shaft outer diameter and have a slight clearance fit between their outer diameters and the headplate bearing seat. Therefore, the bearings should be heated (up to 200 - 225 ° F) before installation onto their respective shaft areas.*
- *The gap between the rotor and the drive end headplate sets the axial position of the rotor. The as new target gap for the drive end axial clearance is 0.006 to 0.008". In some cases, some additional axial clearance is provided for thermal expansion and if wear occurs, the gap may increase. When setting reworked rotor clearances, set the drive end gap between .006" and .008". Measure the blind end axial clearance and record. This information could be useful if troubleshooting is ever needed or in determining the extent of wear.*
- *When setting bearings into the headplates, always apply force on the inner and outer races equally.*





### A. UDV RAL REASSEMBLY PROCEDURE

*(See views of feeder on pages 24& 25 to identify item numbers shown in parentheses)*

Sequence of Assembly for UDV:

1. Before reassembly, inspect headplates, housing, bearings and seals:
  - a. Inspect the bearing and seal bores to insure it is clean and smooth.
  - b. Inspect the bearing (13) to assure it is clean, turns freely and does not drag or bind at any point.
  - c. Do not install the bearing (13) into its housing at this time.
  - d. Inspect inside of housing bore for excessive wear, pits, and other marks. Excessive wear means large clearances and can impact airlock performance.
  - e. Check seals to see if worn or overly compressed. If lantern rings are supplied, check them for wear and plugging of gas ports.
  - f. Clean, repair or replace components, as required.
2. Press the packing seal rings (5) into each headplate. If lantern rings are provided make sure to put them in the correct axial location. For air purge, the lantern ring is placed in the most inboard position. For grease purge, the lantern ring is placed in the second row from the most inboard position.
3. Install the packing gland nuts, studs, nuts and lock washers into each headplate. Tighten the packing gland nut until just touching the packing. This will hold the packing in place as the rotor is installed.
4. Install the drive end headplate onto drive side of housing with associated headplate capscrews (12) and pins (11). Install capscrews hand tight, set pins and then tighten capscrews.
5. Flip assembly so drive end is on bottom. Set up on vertical fixture so rotor can be cleanly dropped into housing and extend through the drive end headplate.
6. Install rotor, with drive end into drive end headplate. Grip the rotor and shaft securely. Slowly and carefully begin working the rotor into the housing and drive end headplate. Avoid dragging the rotor vanes along the housing bore and walls. Never force the rotor into the housing / headplate. Although manufactured to very close tolerances, there is sufficient clearance to permit the rotor to slide into the housing with a minimum of effort. As the rotor passes through the headplate and past the seal assembly, gently rotate it to avoid inverting the edge of the seal. Continue to slide the rotor until completely seated in the housing.
7. Install blind end headplate onto blind side of housing with associated headplate capscrews (12) and pins (11). Install capscrews hand tight, set pins and then tighten capscrews.

8. With the rotor resting on the drive end headplate, measure the clearance between the rotor and the blind side headplate. Subtract .007" from this value: the result will be the blind side clearance. Place shims on the drive and blind end between the rotor and each headplate, as follows:
  - a. The amount of shims on the drive end should be 0.007" ( $\pm 0.01$ ). The amount of shims on the blind end should be equal to the blind side clearance calculated above.
  - b. For temperature applications below 100° F the drive end and blind end axial clearances may be set the same (total measured gap divided by 2).
  - c. For higher temperature applications, some allowance was provided for thermal expansion and the blind end is intended to have a larger gap.
9. Heat the blind end bearing and when heated, drive bearing onto shaft until it is seated at the bottom of the bearing bore of the blind end headplate. NOTICE: When driving a bearing into its headplate seat, be sure to apply axial forces on inner and outer races so as not to damage the bearing.
10. Flip assembly so blind end is on bottom.
11. Heat the drive end bearing and when heated, drive bearing onto shaft until it is seated at the bottom of the bearing bore of the drive end headplate. NOTICE: When driving a bearing into its headplate seat, be sure to apply axial forces on inner and outer races so as not to damage the bearing.
12. Turn valve upright and remove shims. Tighten packing gland nuts until a moderate resistance is felt to turning the rotor. Do not over tighten the packing.
13. Install the blind end bearing cap (14) on the blind end headplate (3). Tighten the bearing cap capscrews.
14. Install the wave spring (16) outboard of the bearing in the drive end headplate.
15. Install the drive base (17) by attaching the mounting capscrews and washers (20 & 24) between the drive base and the headplates.
16. Install the gearbox drive base (17) and gearbox (25), included brackets (18 & 23) and spacer plates (19), with fasteners (12, 20, 21 & 22). Tighten bolts holding brackets to gearbox, but only hand-tighten bolts holding gearbox to drive base.
17. Install the sprockets (31 & 32) on the shafts. Be sure they are aligned.
18. Install the chain (35) and master link (36). Adjust the gearbox (25) for proper chain tension and tighten bolts (12, 20, 21 & 22) holding gearbox to drive base.
19. Mount drive guard cover (37).
20. The valve is now ready to return to service.

**CAUTION** - Before applying power, make sure the valve interior is not exposed, and any purge or signal lines are reconnected.

### **C. DDV RAL REASSEMBLY PROCEDURE**

*(See views of feeder on pages 26 & 27 to identify item numbers shown in parentheses)*

Sequence of Assembly of DDV:

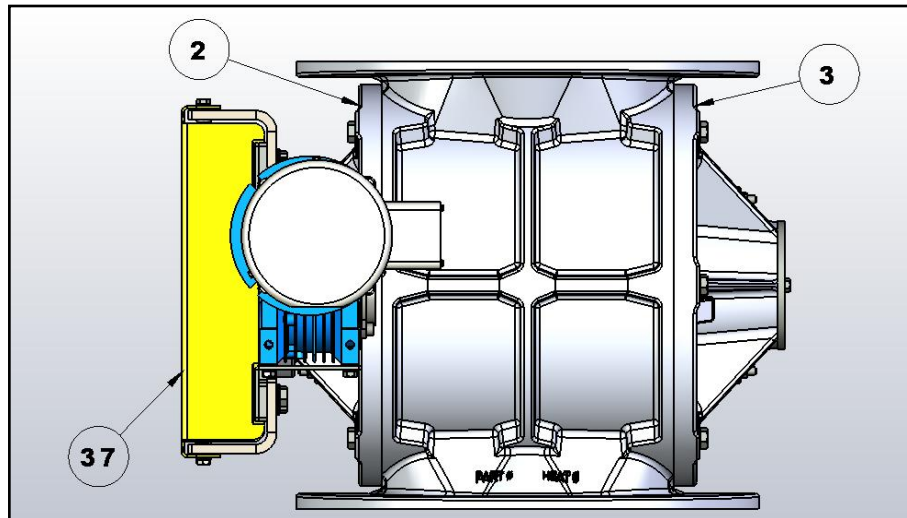
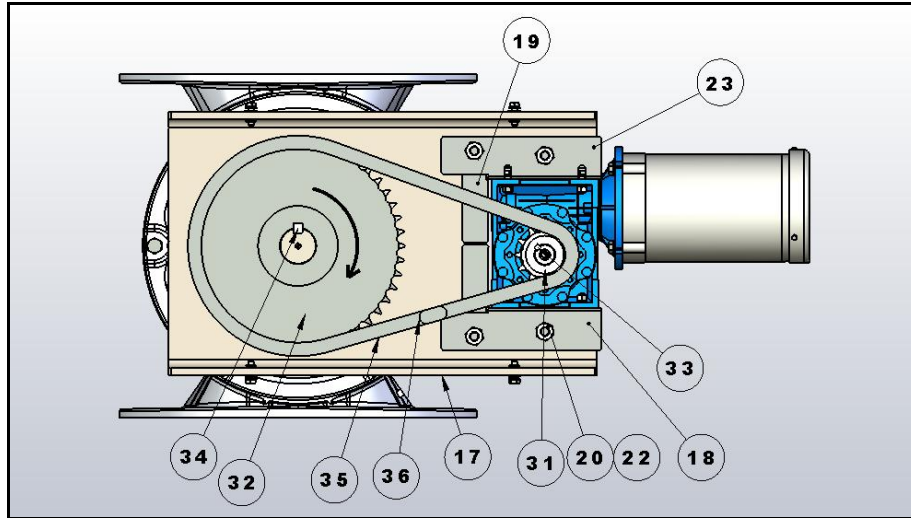
1. Before reassembly, inspect headplates, housing, bearings and seals:
  - a. Rest a headplate (2 or 3) "face down" on a clean surface so that the bearing housing is pointed up. Inspect the bearing housing to insure it is clean and smooth.
  - b. Inspect the bearing (13) to assure it is clean, turns freely and does not drag or bind at any point.
  - c. Do not install the bearing (13) into its housing at this time.
  - d. With the headplate still "face down", inspect the seal housing to insure it is clean and smooth.
  - e. Inspect inside of housing bore for excessive wear, pits, and other marks. Excessive wear means large clearances and can impact airlock performance.
  - f. Check seals to see if worn or overly compressed. If lantern rings are supplied, check them for wear and plugging of air ports.
  - g. Clean, repair or replace components, as required.
2. Press the packing seal rings (5) into the headplate. If lantern rings are provided make sure to put them in the correct axial location. For air purge, the lantern ring is placed in the most inboard position. For grease purge, the lantern ring is placed in the second row from the most inboard position.
3. Install the packing gland nuts, studs, nuts and lock washers into the headplate. Tighten the packing gland nut until just touching the packing. This will hold the packing in place as the rotor is installed.
4. Repeat this procedure for the other headplate.
5. Install the drive end headplate onto drive side of housing with associated headplate capscrews (12) and pins (11). Install capscrews hand tight, set pins and then tighten capscrews.
6. Flip assembly so drive end is on bottom. Set up on vertical fixture so rotor can be cleanly dropped into housing and extend through headplates.
7. Install rotor, with drive end into drive end headplate. Grip the rotor and shaft securely. Slowly and carefully begin working the rotor into the housing and drive end headplate. Avoid dragging the rotor vanes along the housing bore and walls. Never force the rotor into the housing / headplate. Although manufactured to very close tolerances, there is sufficient clearance to permit the rotor to slide into the housing with a minimum of

effort. As the rotor passes through the headplate and past the seal assembly, gently rotate it to avoid inverting the edge of the seal. Continue to slide the rotor until completely seated in the housing.

8. Install blind end headplate onto blind side of housing with associated headplate capscrews (12) and pins (11). Install capscrews hand tight, set pins and then tighten capscrews.
9. With the rotor resting on the drive end headplate measure the clearance between the rotor and the blind side headplate. Subtract .007" from this value; the result will be the blind side clearance. Place shims on the drive and blind end between the rotor and each headplate, as follows:
  - a. The amount of shims on the drive end should be 0.007" ( $\pm 0.01$ ). The amount of shims on the blind end should be equal to the blind side clearance calculated above.
  - b. For temperature applications below 100° F the drive end and blind end axial clearances may be set the same (total measured gap divided by 2).
  - c. For higher temperature applications, some allowance was provided for thermal expansion and the blind end is intended to have a larger gap.
10. Heat the blind end bearing and when heated, drive bearing onto shaft until it is seated at the bottom of the bearing bore of the blind end headplate. **NOTICE:** When driving a bearing into its headplate seat, be sure to apply axial forces on inner and outer races so as not to damage the bearing.
11. Flip assembly so blind end is on bottom.
12. Heat the drive end bearing and when heated, drive bearing onto shaft until it is seated at the bottom of the bearing bore of the drive end headplate. **NOTICE:** When driving a bearing into its headplate seat, be sure to apply axial forces on inner and outer races so as not to damage the bearing.
13. Turn valve upright and remove shims. Tighten packing gland nuts until a moderate resistance is felt to turning the rotor. Do not over tighten the packing.
14. Install the blind end bearing cap (14) on the blind end headplate (3). Tighten the bearing cap capscrews.
15. Install the wave spring (16) outboard of the bearing in the drive end headplate.
16. Install bearing retainer plate (17).
17. Install the gearbox (18) with fasteners (20 & 21). Tighten bolts holding gearbox to headplate.
18. The valve is now ready to return to service.

**Caution** - Before applying power, make sure the valve interior is not exposed, and any purge or signal lines are reconnected.

## PARTS LIST AND DRAWING FOR UDV ROTARY AIRLOCK

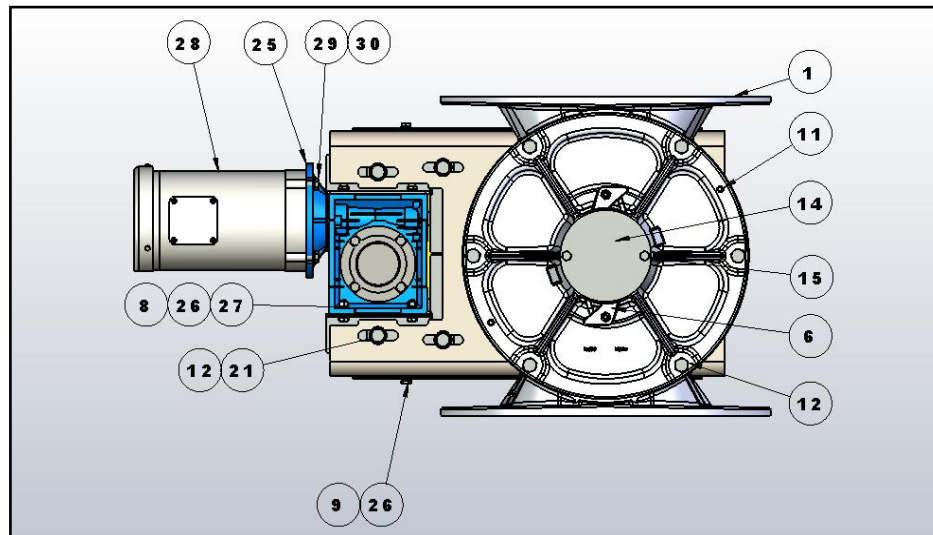
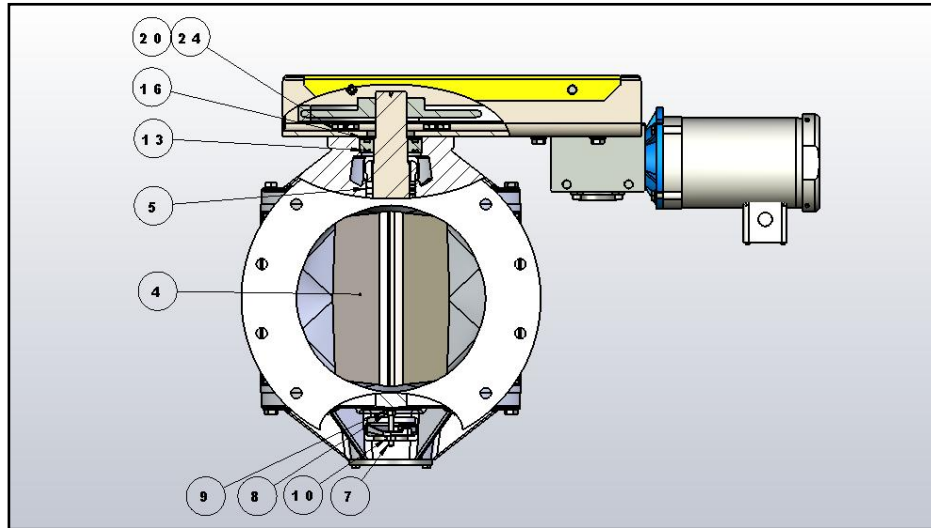


ITEM NO.	Description	QTY.
1	UDV ROUND HOUSING	1
2	UDV DRIVE HEADPLATE	1
3	UDV BLIND HEADPLATE	1
4	UDV ROTOR*	1
5	PACKING RING*	6
6	PACKING NUT	4
7	PACKING NUT STUD	4
8	HEX NUT	10
9	LOCK WASHER	8
10	CENTER LOCK HEX LOCKNUT	4
11	ROLL PIN**	4
12	HEX HEAD CAP SCREW	16
13	SEALED BALL BEARING*	2
14	BLIND END BEARING CAP	1
15	HEX HEAD BOLT	2
16	WAVE SPRING**	1
17	DRIVE BASE	1
18	GEAR BOX BOTTOM BRACKET	1
19	GEARBOX SPACER	2
20	NORD LOCK WASHER	12
21	NORD LOCK WASHER	4
22	HEAVY HEX NUT	4
23	GEARBOX TOP BRACKET	1
24	HEX HEAD CAP SCREW	8
25	30:1 GEAR BOX	1
26	HEX HEAD BOLT	10
27	NORD LOCK WASHER	12
28	MOTOR TEFC 1800 RPM 3/60/208-230/460	1
29	HEX HEAD BOLT	4
30	LOCK WASHER	4
31	DRIVESPROCKET**	1
32	DRIVEN SPROCKET**	1
33	DRIVESPROCKET KEY**	1
34	DRIVEN SPROCKET KEY**	1
35	CHAIN	~
36	CHAIN MASTER LINK	1
37	DRIVEGUARD	1

\*Recommended Spare Parts

\*\* Optional Spare Parts

## PARTS LIST AND DRAWING FOR UDV ROTARY AIRLOCK (CONT'D)



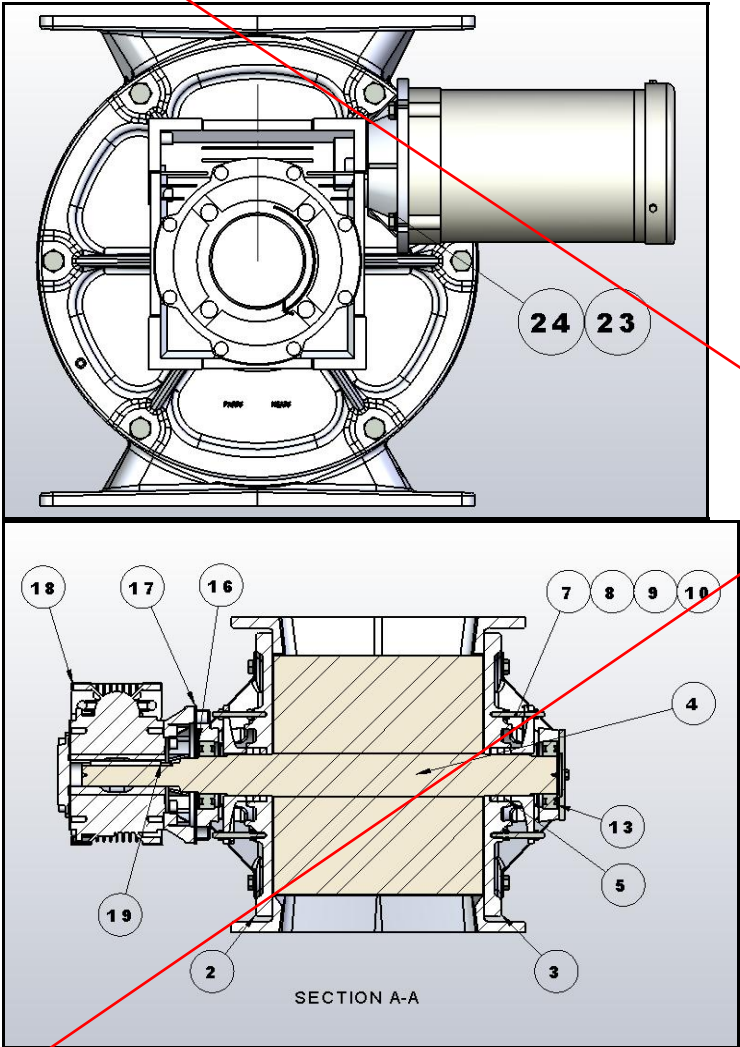
ITEM NO.	Description	QTY.
1	UDV ROUND HOUSING	1
2	UDV DRIVE HEADPLATE	1
3	UDV BLIND HEADPLATE	1
4	UDV ROTOR*	1
5	PACKING RING*	6
6	PACKING NUT	4
7	PACKING NUT STUD	4
8	HEX NUT	10
9	LOCKWASHER	8
10	CENTER LOCK HEX LOCKNUT	4
11	ROLL PIN**	4
12	HEX HEAD CAP SCREW	16
13	SEALED BALL BEARING*	2
14	BLIND END BEARING CAP	1
15	HEX HEAD BOLT	2
16	WAVE SPRING**	1
17	DRIVE BASE	1
18	GEAR BOX BOTTOM BRACKET	1
19	GEARBOX SPACER	2
20	NORD LOCK WASHER	12
21	NORD LOCK LOCK WASHER	4
22	HEAVY HEX NUT	4
23	GEARBOX TOP BRACKET	1
24	HEX HEAD CAP SCREW	8
25	30:1 GEAR BOX	1
26	HEX HEAD BOLT	10
27	NORD LOCK WASHER	12
28	MOTOR TEFC 1800 RPM 3/60/208-230/460	1
29	HEX HEAD BOLT	4
30	LOCK WASHER	4
31	DRIVES PROCKET**	1
32	DRIVEN SPROCKET**	1
33	DRIVES PROCKET KEY**	1
34	DRIVEN SPROCKET KEY**	1
35	CHAIN	~
36	CHAIN MASTER LINK	1
37	DRIVE GUARD	1

\*Recommended Spare Parts

\*\* Optional Spare Parts



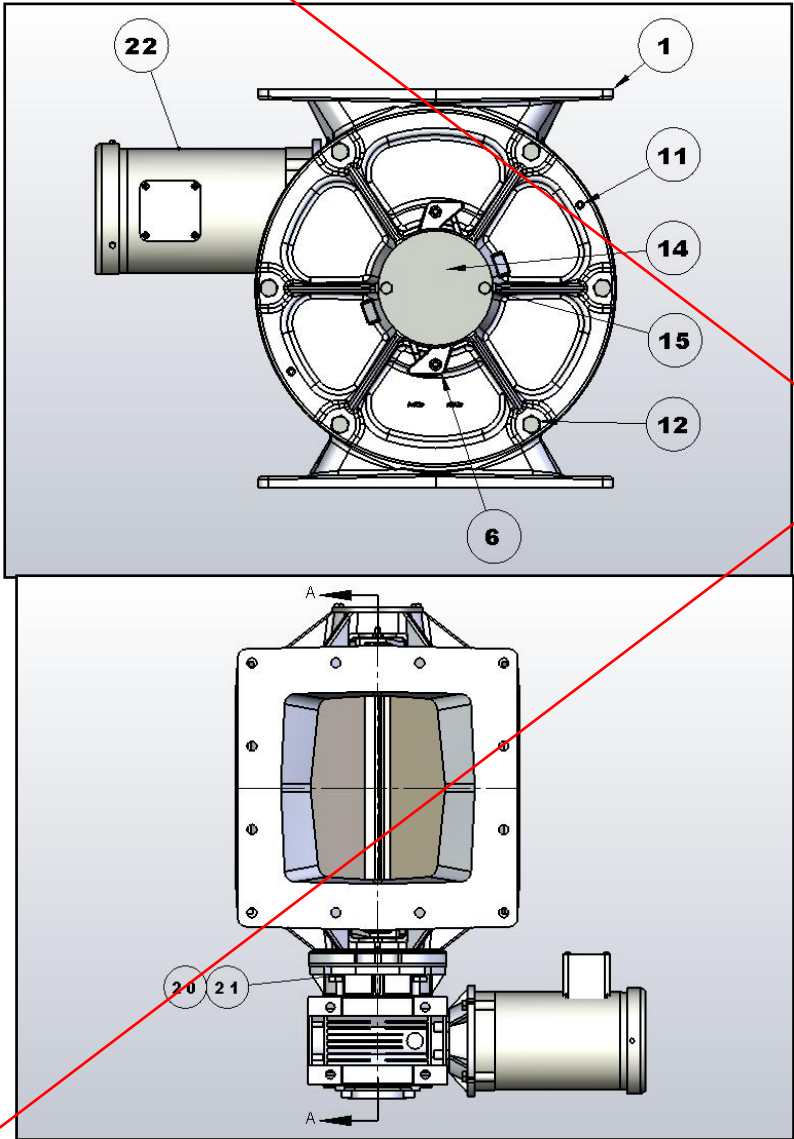
PARTS LIST AND DRAWING FOR DDV ROTARY AIRLOCK



ITEM NO.	Description	QTY.
1	DDV SQUARE HOUSING	1
2	DDV DRIVE HEADPLATE	1
3	DDV BLIND HEADPLATE	1
4	DDV ROTOR*	1
5	PACKING RING*	6
6	PACKING NUT	4
7	PACKING NUT STUD	4
8	HEX NUT	4
9	LOCK WASHER	4
10	CENTER LOCK HEX LOCK NUT	4
11	ROLL PIN	4
12	HEX HEAD CAP SCREW	12
13	SEALED BALL BEARING*	2
14	BLIND END BEARING CAP	1
15	HEX HEAD BOLT	2
16	WAVE SPRING*	1
17	BEARING RETAINER	1
18	80:1 GEARBOX	1
19	GEARBOX TO ROTOR KEY*	1
20	HEX HEAD BOLT	4
21	NORD LOCK WASHER	4
22	MOTOR TEFC 1800 RPM 3/60/208-230/460	1
23	HEX HEAD BOLT	4
24	LOCK WASHER	4

\*Recommended Spare Parts  
\*\* Optional Spare Parts

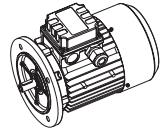
PARTS LIST AND DRAWING FOR DDV ROTARY AIRLOCK (CONT'D)



ITEM NO.	Description	QTY.
1	DDV SQUARE HOUSING	1
2	DDV DRIVE HEAD PLATE	1
3	DDV BLIND HEAD PLATE	1
4	DDV ROTOR*	1
5	PACKING RING*	6
6	PACKING NUT	4
7	PACKING NUT STUD	4
8	HEX NUT	4
9	LOCK WASHER	4
10	CENTER LOCK HEX LOCKNUT	4
11	ROLL PIN	4
12	HEX HEAD CAP SCREW	12
13	SEALED BALL BEARING*	2
14	BLIND END BEARING CAP	1
15	HEX HEAD BOLT	2
16	WAVE SPRING*	1
17	BEARING RETAINER	1
18	80:1 GEAR BOX	1
19	GEARBOX TO ROTOR KEY*	1
20	HEX HEAD BOLT	4
21	NORD LOCK WASHER	4
22	MOTOR TEFC 1800 RPM 3/60/208-230V/50	1
23	HEX HEAD BOLT	4
24	LOCK WASHER	4

\*Recommended Spare Parts  
\*\* Optional Spare Parts





## AC Motor Ratings, 60Hz

### 4 Poles

IEC Frame	model	HP	KW	Voltage	RPM 230V	F.L. Amps 230V	% F.L. Eff. 230V	RPM 460V	F.L. Amps 460V	% F.L. Eff. 460V
63	63A	0.16	0.12	230/460	1650	0.83	51.4	1690	0.52	49.4
63	63B	0.25	0.18	230/460	1650	1.10	56.9	1690	0.65	56.5
63	63C	0.30	0.22	230/460	1660	1.30	66.2	1700	0.81	62.8
71	71A	0.33	0.25	230/460	1700	1.15	71.2	1730	0.65	69.0
71	71B	0.50	0.37	230/460	1700	1.70	70.1	1730	0.95	69.6
71	71C	0.75	0.55	230/460	1680	2.50	68.9	1710	1.35	69.4
80	80A	0.75	0.55	230/460	1710	2.45	72.6	1740	1.35	72.2
80	80B	1.00	0.75	230/460	1700	3.1	71.9	1750	1.8	70.8
80	80C	1.20	0.92	230/460	1710	4.0	75.1	1750	2.2	73.1
90S	90S	1.5	1.1	230/460	1670	4.4	75.5	1720	2.3	76.7
90L	90L	2.0	1.5	230/460	1700	5.7	76.5	1720	3.1	77.3
90L	90LL	2.5	1.84	230/460	1670	7.5	76.5	1730	4.1	76.7
100	100LA	3.0	2.2	230/460	1710	8.9	76.0	1740	4.7	77.9
100	100LB	4.0	3.0	230/460	1720	11.1	81.8	1740	6.0	82.1
112	112M	5.5	4	230/460	1730	14.7	81.6	1750	8.1	82.5
112	112MS	6.4	4.8	230/460	1710	17.5	82.3	1740	9.2	83.3
132S	132S	7.5	5.5	230/460	1740	20.5	83.7	1760	11.2	84.0
132L	132L	10	7.5	230/460	1740	27.4	84.8	1760	15.0	85.3
132L	132M	12	9.2	230/460	1720	32.4	82.6	1750	17.5	85.0

## Selection & Specification Data

<b>Generic Type</b>	<b>Epoxy Polyamide</b>
<b>Description</b>	Carboguard 60 is a high solids, versatile corrosion resistant coating. It can be used as a primer, intermediate coat, or self-priming finish over steel or inorganic zinc primers. May be topcoated with itself, or a broad variety of high performance finish coats. This product has excellent wetting properties giving it the capability of going over marginally prepared substrates. It is ideal for maintenance and fabrication shop applications. An optional Glass Flake (GF) additive or micaceous iron oxide (MiO) additive can be purchased separately and may be used to enhance film strength for more abusive applications for severe marine or heavy industrial uses. Carboguard 60 is suitable for use as a blast-hold primer for tank linings used in crude oil storage, fuel oils, gasoline and water/wastewater up to 140°F (60°C). Consult Technical Service for suitable linings or for other exposures.
<b>Features</b>	<ul style="list-style-type: none"> <li>• Low odor and low VOC</li> <li>• Available in a variety of rapid tint colors</li> <li>• Attractive medium sheen for tank exteriors</li> <li>• Used as a primer, intermediate, or finish coat</li> <li>• Fast cure &amp; dry times</li> <li>• Can be applied over power tool cleaned surfaces</li> <li>• VOC compliant to current AIM regulations</li> </ul>
<b>Color</b>	Primer color (0700) gray. Variety of other finish coat colors in rapid tint service. MiO additive will darken (grey) all colors.
<b>Finish</b>	Semi-Gloss
<b>Primer</b>	<b>Self-priming.</b> May be applied over organic and inorganic zinc rich primers. A mist coat may be required to minimize bubbling over zinc rich primers.
<b>Topcoat</b>	May be topcoated with Acrylics, Epoxies, Alkyds, or Polyurethanes depending on exposure and need.
<b>Dry Film Thickness</b>	<b>4.0 - 6.0 mils (102 - 152 microns) per coat as a primer</b> or an intermediate without additives 4.0 - 10.0 mils (102 - 254 microns) per coat (2 coats) may be used direct-to-metal 8.0 - 12.0 mils (203 - 305 microns) per coat with GF or MiO additives  Do not exceed 10 mils in a single coat (without additives)
<b>Solids Content</b>	By Volume 72% +/- 2%
<b>Theoretical Coverage Rate</b>	1155 ft <sup>2</sup> at 1.0 mils (28.3 m <sup>2</sup> /l at 25 microns) 289 ft <sup>2</sup> at 4.0 mils (7.1 m <sup>2</sup> /l at 100 microns) 96 ft <sup>2</sup> at 12.0 mils (2.4 m <sup>2</sup> /l at 300 microns)  Allow for loss in mixing and application.
<b>VOC Values</b>	Thinner 2 13 oz/gal 2.47 lbs./gal 296 g/l Thinner 2 6 oz/gal 2.23 lbs./gal 267 g/l Thinner 33 15 oz/gal 2.57 lbs./gal 308 g/l As Supplied 2.00 lbs./gal 240 g/l  These are nominal values for the liquid components only and may vary slightly with color and with the addition of GF or MiO fillers.

ONE COAT

## Selection & Specification Data

<b>Dry Temp. Resistance</b>	Continuous: 300 °F (149 °C) Non-Continuous: 350 °F (177 °C)  Exposure above 200°F/93°C may cause discoloration (darkening) or loss of gloss, but will not affect performance.
<b>Limitations</b>	RTS colors and the use of Additive 8505 with this product are not recommended for immersion. Additive 8505 will cause discoloration of this product, but will not affect product performance.
<b>General</b>	Surfaces must be clean and dry. Employ adequate methods to remove dirt, dust, oil and all other contaminants that could interfere with adhesion of the coating.
<b>Steel</b>	For most applications: Immersion: SSPC-SP10 <b>Non-immersion: SSPC-SP6</b> 1.5-3.0 mils (38-75 microns)
<b>Galvanized Steel</b>	SSPC-SP16
<b>Concrete or CMU</b>	Concrete must be cured 28 days at 75°F (24°C) and 50% relative humidity or equivalent. Prepare surfaces in accordance with ASTM D4258 Surface Cleaning of Concrete and ASTM D4259 Abrading Concrete. Voids in concrete may require surfacing.

**Previously Painted Surfaces** SSPC-SP2 or SP3

## Performance Data

Test Method	System	Results
ASTM D2794 Impact resistance	Blasted Steel 1ct.	100 in. lbs (direct)
ASTM D3366 Pencil Hardness	Blasted Steel 1 ct.	4H-5H
ASTM D4541 Adhesion	Blasted Steel 1ct. 2ct.	(Pneumatic) 1 ct. 1500+psi 2 ct. 1500+ psi
ASTM D522 Flexibility	Blasted Steel 1 ct.	No cracking, 5/8" Conical Mandrel Bend

Data based on Carboguard 60 without filler additives.

## Mixing & Thinning

<b>Mixing</b>	Power mix separately, then combine and power mix. Allow mixed product 15 minute sweat in time before thinning if material is under 70°F. No sweat in needed above 70°F DO NOT MIX PARTIAL KITS. For GF or MiO additives, slowly add while mixing.
<b>Thinning</b>	Spray: Up to 13 oz/gal (10%) with Thinner #2. Brush & Roller: Up to 15 oz/gal (12%) with Thinner #33. Thinner 236E or 250E may be used as an exempt thinner in lieu of those listed above. Use of thinners other than those supplied or recommended by Carboline may adversely affect product performance and void product warranty, whether expressed or implied.

June 2016

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# Carboguard® 60

## Mixing & Thinning

- Ratio**
- Liquid Components: 1:1 Ratio (A to B)
  - Glass Flake (GF) Additive: (1.8 lbs/mixed gal)
  - Micaceous Iron Oxide (MiO) Additive: (2.0 lbs/gal)

**Pot Life** 4 Hours at 75°F (24°C)  
Pot life ends when coating loses body and begins to sag. Pot life times will be less at higher temperatures.

Carboline Additive 8505 can be used to aid the film forming process in the product for temperatures down to 35°F. Carboline Additive 8505 is added at a rate of 4 oz per mixed two gallon kit or 20 oz per mixed ten gallon kit. Allow mixed product 15 minute sweat in time before thinning, if material is under 70°F, and 24 hrs cure prior to topcoating for surface temperatures down to 40°F. At this addition rate, Additive 8505 will accelerate the cure rate of the epoxy product and reduce the pot life of the product.

## Application Equipment Guidelines

Listed below are general equipment guidelines for the application of this product. Job site conditions may require modifications to these guidelines to achieve the desired results.

- Conventional Spray** Pressure pot equipped with dual regulators, 3/8" I.D. minimum material hose, .070" I.D. fluid tip and appropriate air cap. For filler additives use a 0.110" I.D. fluid tip.
- Airless Spray** Pump Ratio: 30:1 (min.)\*  
GPM Output: 2.5 (min.)  
Material Hose: 3/8" I.D. (min.)  
Tip Size: .017"-.021" (.035"-.041" for filler additives)  
Output PSI: 2100-2500  
Filter Size: 60 mesh (remove mesh for filler additives)  
PTFE packings are recommended and available from the pump manufacturer.
- Brush & Roller (General)** Not recommended for tank lining applications except when striping welds. Multiple coats may be required to obtain desired appearance, recommended dry film thickness and adequate hiding. Avoid excessive re-brushing or re-rolling. For best results, tie-in within 10 minutes at 75°F (24°C). The addition of GF or MiO fillers is best applied by spray application.
- Brush** Use a medium bristle brush.
- Roller** Use 3/8" nap roller with a solvent resistant core.

## Application Conditions

Condition	Material	Surface	Ambient	Humidity
Minimum	50 °F (10 °C)	40 °F (4 °C)	40 °F (4 °C)	0%
Maximum	90 °F (32 °C)	140 °F (60 °C)	120 °F (49 °C)	85%

This product simply requires the substrate temperature to be above the dew point. Condensation due to substrate temperatures below the dew point can cause flash rusting on prepared steel and interfere with proper adhesion to the substrate. Special application techniques may be required above or below normal application conditions.

## Curing Schedule

Surface Temp.*	Dry to Handle	Dry to Recoat	Dry to Touch	Maximum Recoat Time
40 °F (4 °C)	30 Hours	48 Hours	3 Hours	1.0 Years
50 °F (10 °C)	20 Hours	24 Hours	2 Hours	1.0 Years
60 °F (16 °C)	8 Hours	10 Hours	1 Hours	1.0 Years
75 °F (24 °C)	5 Hours	7 Hours	45.0 Minutes	1.0 Years
90 °F (32 °C)	3 Hours	4 Hours	30.0 Minutes	1.0 Years

\*These times are based on a 5.0 mil (125 micron) dry film thickness and 50% RH. Higher film thickness, insufficient ventilation or cooler temperatures will require longer cure times and could result in solvent entrapment and premature failure. Excessive humidity or condensation on the surface during curing can interfere with the cure, can cause discoloration and may result in a surface haze. Any haze or bluish must be removed by water washing before recoating.

**NOTE:** The maximum recoat times in the chart above are for atmospheric exposures. When used as a blast-hold primer, maximum recoat time is limited to 30 days. If the maximum recoat times have been exceeded, the surface must be abraded by sweep blasting or sanding prior to the application of additional coats. For force curing, contact Carboline Technical Service for specific requirements.

## Cleanup & Safety

- Cleanup** Use Thinner #2 or Acetone. In case of spillage, absorb and dispose of in accordance with local applicable regulations.
- Safety** Read and follow all caution statements on this product data sheet and on the MSDS for this product. Employ normal workmanlike safety precautions.
- Ventilation** When used in enclosed areas, thorough air circulation must be used during and after application until the coating is cured. The ventilation system should be capable of preventing the solvent vapor concentration from reaching the lower explosion limit for the solvents used. User should test and monitor exposure levels to insure all personnel are below guidelines. If not sure or if not able to monitor levels, use MSHA/NIOSH approved respirator.

## Packaging, Handling & Storage

- Shelf Life** Part A & B: Min. 36 months at 75°F (24°C)  
\*Shelf Life: (actual stated shelf life) when kept at recommended storage conditions and in original unopened containers.
- Shipping Weight (Approximate)** 2 Gallon Kit 26 lbs. (12 kg)  
10 Gallon Kit 127 lbs. (58 kg)
- Storage Temperature & Humidity** 40° - 100°F (4° - 37.8°C)  
0-100% Relative Humidity
- Flash Point (Setaflash)** Part A: 82°F (27.8°C)  
Part B: 71°F (21.7°C)  
Mixed: 78°F (25.6°C)
- Storage** Store Indoors.  
This product is solvent based and not affected by excursions below these published storage temperatures, down to 10°F, for a duration of no more than 14 days. Always inspect the product prior to use to make sure it is smooth and homogeneous when properly mixed.



June 2016

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product data


**carboline**®
**Carbothane® 133 HB****Selection & Specification Data**

<b>Generic Type</b>	<b>Aliphatic Acrylic-Polyester Polyurethane</b>
<b>Description</b>	High build, low sheen finish that has excellent resistance to corrosion, chemicals and abrasion. Suitable for application over a number of Carboline primers and intermediates, this material provides very good weathering performance in a broad range of colors.
<b>Features</b>	<ul style="list-style-type: none"> <li>• Outstanding performance properties in both mild and aggressive environments</li> <li>• High build; suitable for many two-coat systems</li> <li>• Suitable for application direct to inorganic zincs</li> <li>• Application by spray, brush or roller</li> <li>• Indefinite recoatability</li> <li>• VOC compliant to current AIM regulations</li> </ul>
<b>Color</b>	Refer to Carboline Color Guide. Certain colors may require multiple coats to hide.
<b>Finish</b>	Satin
<b>Primer</b>	Refer to Substrates & Surface Preparation. Topcoat with Carbothane® Clear Coat when required.
<b>Dry Film Thickness</b>	<b>3.0 - 5.0 mils (76 - 127 microns) per coat</b> <b>ONE COAT</b> Dry film thickness in excess of 7 mils (175 microns) per coat is not recommended.
<b>Solids Content</b>	By Volume 57% +/- 2%
<b>Theoretical Coverage Rate</b>	914 ft <sup>2</sup> at 1.0 mils (22.4 m <sup>2</sup> /l at 25 microns) 305 ft <sup>2</sup> at 3.0 mils (7.5 m <sup>2</sup> /l at 75 microns) 183 ft <sup>2</sup> at 5.0 mils (4.5 m <sup>2</sup> /l at 125 microns)
<b>VOC Values</b>	Allow for loss in mixing and application. Thinner 214 3.3 lbs/gal (403 g/l) Thinner 241 3.5 lbs/gal (423 g/l) Thinner 25 11 oz/gal: 3.5 lbs./gal (420 g/l) Thinner 25 18 oz/gal: 3.7 lbs./gal (449 g/l) As Supplied 3.2 lbs./gal (383 g/l) 1.5 oz/gal of Additive 101 adds 0.08 lbs/gal (10 g/l). These are nominal values and may vary slightly with color.
<b>Dry Temp. Resistance</b>	Continuous: 200 °F (93 °C) Non-Continuous: 250 °F (121 °C) Discoloration and loss of gloss is observed above 200°F (93°C)
<b>Limitations</b>	*The alignment of aluminum flakes in aluminum-filled finishes is very dependent on application conditions and techniques. Care must be taken to keep conditions as constant as possible to reduce variations in final appearance. It is also advisable to work from a single batch of material since variations can occur from batch to batch.

**Substrates & Surface Preparation**

<b>General</b>	Surfaces must be clean and dry. Employ adequate methods to remove dirt, dust, oil and all other contaminants that could interfere with adhesion of the coating. Refer to the specific primer's Product Data Sheet for detailed requirements of the specified primer.
<b>Steel</b>	SSPC-SP6 with a 1.5-2.5 mil (37.5-62.5 micron) surface profile for maximum protection. SSPCSP2 or SP3 as minimum requirement. Prime with specific Carboline primers as recommended by your Carboline sales representative.
<b>Galvanized Steel</b>	Prime with specific Carboline primers as recommended by your Carboline Sales Representative. Refer to the specific primer's Product Data Sheet for substrate preparation requirements.
<b>Aluminum</b>	SSPC-SP1 and prime with appropriate Carboline primer as recommended by your Carboline sales representative.
<b>Previously Painted Surfaces</b>	Lightly sand or abrade to roughen and degloss the surface. Existing paint must attain a minimum 3A rating in accordance with ASTM D3359 "X-Scratch" adhesion test. Prime with specific Carboline primers as recommended by your Carboline sales representative.

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# Carbothane® 133 HB

## Performance Data

Test Method	System	Results
ASTM B117 Salt Fog	Blasted Steel 1 ct. IOZ 1 ct. 133 HB	No rusting, or blistering on plane or scribe 2,000 hours
ASTM B117 Salt Fog	Blasted Steel 1 ct. OZ 1 ct. 133 HB	No rusting, or blistering on plane or scribe 4,000 hours
ASTM D1735 Water Fog	Blasted Steel 1 ct. Epoxy 1 ct. 133 HB	No rusting or blistering after 8600 hours.
ASTM D4213 Scrub Resistance	1 ct. 133 HB	.0027 microliters erosion rate after 100 cycles with abrasive scrub medium.
ASTM D4585 Humidity	Blasted Steel 1 ct. IOZ 1 ct. 133 HB	No rusting or blistering after 3000 hours.
ASTM D5894 QUV A Prohesion	1 ct. 133 HB	No effect on plane area and 78% gloss retention after 1008 hours of wet/dry salt fog cycle
ASTM G26 Weatherometer	Blasted Steel 1 ct IOZ 1 ct. 133 HB	No blistering, rusting or cracking after 3500 hours
ASTM G53 QUV (2500 hours w/ UVA 340 bulb)	Blasted Steel 1 ct. Epoxy 1 ct. 133 HB	Color change less than 2 McAdam units; no blistering, rusting, cracking or chalking.
Graffiti Resistance	Blasted Steel 1 ct. Epoxy 1 ct. 133 HB	All markings and stains removed by solvent after exposure to: shoe polish, Sharpie marker, crayon, l

Test reports and additional data available upon request.

## Mixing & Thinning

### Mixing

Power mix Part A separately, then combine with Part B and power mix. DO NOT MIX PARTIAL KITS.

### Thinning

Spray: Up to 11 oz/gal (9%) w/ Thinner 25.  
Roller: Up to 18 oz/gal (14%) w/ Thinner 25.  
Use of thinners other than those supplied or recommended by Carboline may adversely affect product performance and void product warranty, whether expressed or implied. Thinner 214 may also be used, up to 6 oz/gal, for either spray or brush/roller application. Carboline Thinner 236E may also be used to minimize HAP and VOC emissions.

### Ratio

6:1 Ratio (A to B)  
**.88 Gal. Kit**  
Part A: 1 gal. can (partial filled)  
UC 133: 1 pint  
**5.0 Gal. Kit**  
Part A: 5 gal. can (partial filled)  
UC 133: 1 gallon can (partial filled)

### Pot Life

4 Hours at 75°F (24°C) and less at higher temperatures. Pot life ends when coating becomes too viscous to use. MOISTURE CONTAMINATION WILL SHORTEN POT LIFE AND CAUSE GELLATION.

## Application Equipment Guidelines

Listed below are general equipment guidelines for the application of this product. Job site conditions may require modifications to these guidelines to achieve the desired results.

### Spray Application (General)

This is a high solids coating and may require adjustments in spray techniques. Wet film thickness is easily and quickly achieved. The following spray equipment has been found suitable and is available from manufacturers such as Binks, DeVilbiss and Graco.

### Conventional Spray

Pressure pot equipped with dual regulators  
3/8" I.D. minimum material hose  
.070" I.D. fluid tip and appropriate air cap

### Airless Spray

Pump Ratio: 30:1 (min.)\*  
GPM Output: 3.0 (min.)  
Material Hose: 3/8" I.D. (min.)  
Tip Size: .013-.015"  
Output PSI: 2100-2300  
Filter Size: 60 mesh  
\*Teflon packings are recommended and available from the pump manufacturer.

### Brush & Roller (General)

Multiple coats may be required to obtain desired appearance, recommended dry film thickness and adequate hiding. Avoid excessive re-brushing or rerolling. For best results, tie-in within 10 minutes at 75°F (24°C).

### Brush

Recommended for touch-up only. Use a medium, natural bristle brush.

### Roller

Use a medium-nap synthetic roller cover with phenolic core.

## Application Conditions

Condition	Material	Surface	Ambient	Humidity
Minimum	40 °F (4 °C)	40 °F (4 °C)	40 °F (4 °C)	0%
Maximum	100 °F (38 °C)	110 °F (43 °C)	110 °F (43 °C)	90%

Industry standards are for substrate temperatures to be 5°F (3°C) above the dew point. This product simply requires the substrate temperature to be above the dew point.

**Caution:** This Product is moisture sensitive in the liquid stage and until cured. Protect from high humidity, dew and direct moisture contact until cured. Application and/or curing in humidities above maximum, or exposure to moisture from rain or dew may result in a loss of gloss and/or microbubbling of the product.

## Curing Schedule

Surface Temp. *	Dry to Handle	Dry to Recoat	Final Cure General
40 °F (4 °C)	20 Hours	20 Hours	28 Days
50 °F (10 °C)	12 Hours	12 Hours	14 Days
75 °F (24 °C)	5 Hours	5 Hours	7 Days
90 °F (32 °C)	1 Hours	1 Hours	4 Days

These times are based on a 3.0-5.0 mil (75-125 micron) dry film thickness. Higher film thickness, insufficient ventilation or cooler temperatures will require longer cure times and could result in solvent entrapment and premature failure.

**\*Maximum recoat times are indefinite.** Surface must be clean and dry. As part of good painting practice it is recommended to test for adhesion by wiping the surface with Thinner 25. If the film shows a slight "tack" the surface is suitable for recoating without extensive surface preparation such as abrading.

Carboline Additive 101 can be used to accelerate the film forming process in this product for conditions outside of the parameters of this data sheet. Carboline Additive 101 is added at a rate of 1.0-2.0 oz per mixed gallon or a maximum of 6 oz per mixed five gallons. At this addition rate, Additive 101 will accelerate the cure rate of the urethane product between 25-40% depending on the substrate temperature range and reduce the pot life of the product by approximately 40-50% of that stated on the product data sheet. With the use of Additive 101, this product will continue to cure at temperatures as low as 20°F (-7°C).

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# Carbothane<sup>®</sup> 133 HB

## Cleanup & Safety

<b>Cleanup</b>	Use Thinner 2 or Acetone. In case of spillage, dispose of in accordance with local applicable regulations.
<b>Safety</b>	Read and follow all caution statements on this product data sheet and on the MSDS for this product and use personal protective equipment as directed.
<b>Ventilation</b>	When used in enclosed areas, thorough air circulation must be used during and after application until the coating is cured. The ventilation system should be capable of preventing the solvent vapor concentration from reaching the lower explosion limit for the solvents used. User should test and monitor exposure levels to insure all personnel are below guidelines. If not able to monitor levels, use MSHA/NIOSH approved supplied air respirator.

## Packaging, Handling & Storage

<b>Shelf Life</b>	Part A: Min. 36 months at 75°F (24°C) Part B: Min. 24 months at 75°F (24°C)  <small>*Shelf Life: when kept at recommended storage conditions and in original unopened containers.</small>
<b>Shipping Weight (Approximate)</b>	.875 Gallon Kit - 11 lbs. (5 kg) 5 Gallon Kit - 64 lbs. (29 kg)
<b>Storage Temperature &amp; Humidity</b>	40° -110°F (4°-43°C) 0-90% Relative Humidity
<b>Flash Point (Setaflash)</b>	Part A: 95°F (35°C) Part B: 91°F (33°C)
<b>Storage</b>	Store Indoors.  <small>This product is solvent based and not affected by excursions below these published storage temperatures, down to 10°F, for a duration of no more than 14 days. Always inspect the product prior to use to make sure it is smooth and homogeneous when properly mixed.</small>



July 2015

To the best of our knowledge the technical data contained herein is true and accurate on the date of publication and is subject to change without prior notice. User must contact Carboline Company to verify correctness before specifying or ordering. No guarantee of accuracy is given or implied. We guarantee our products to conform to Carboline quality control. We assume no responsibility for coverage, performance or injuries resulting from use. Liability, if any, is limited to replacement of products. NO OTHER WARRANTY OR GUARANTEE OF ANY KIND IS MADE BY CARBOLINE, EXPRESS OR IMPLIED, STATUTORY, BY OPERATION OF LAW, OR OTHERWISE, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Carboline® and Carboguard® are registered trademarks of Carboline Company.

0840





**Komline-Sanderson**

12 Holland Av  
908-234-1000

Peapack, NJ 07977-0257  
Fax: 908-234-9487  
[www.komline.com](http://www.komline.com)

## OPERATION AND MAINTENANCE MANUAL

Title of Project: Lake County Public Works Department  
Des Plaines River WRF  
Phases 2B & 3 Improvements

Specification Number: 11650H paragraph 2.4I

Specification Title: Detail Biosolids Thermal Drying System  
Dry Silo Bin Vents

Manufacturer: Komline-Sanderson

General Contractor: Williams Brothers Construction, Inc.

Subcontractor:

Supplier: Komline-Sanderson

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O&M MANUAL SUBMITTAL CHECKLIST (Page 1 of 5)

PROJECT NAME Des Plaines River WRF

CONTRACT NO. Phases 2B and 3 Improvements

CONTRACTOR Williams Brothers Construction, Inc.

EQUIPMENT/SYSTEM Dry Silo Bin Vents

SECTION NO. 11650H Paragraph 2.4I

MANUFACTURER/VENDOR Coperion K-tron

FORMAT

Size: 8-1/2 x 11 or 11 x 17  
Paper: 20-pound minimum  
Text: Printed data/neatly typed  
Drawings: Standard size bound in text; in text-size labeled envelopes

Tabbed Section Dividers

Cover Label: Title  
Project Name  
Building/Structure ID  
Equipment Name  
Specification Section

Binders: Plastic Cover

O&M MANUAL SUBMITTAL CHECKLIST (Page 2 of 5)

GENERAL CONTENTS

<u>Provided</u>	<u>Not Applicable</u>	<u>Page No.</u>	
<u>X</u>	<u>      </u>	<u>11-13</u>	One Specification Only
<u>X</u>	<u>      </u>	<u>1</u>	Title Page:
<u>X</u>	<u>      </u>	<u>1</u>	Title
<u>X</u>	<u>      </u>	<u>1</u>	Project title
<u>      </u>	<u>X</u>	<u>      </u>	Building/structure ID
<u>X</u>	<u>      </u>	<u>1</u>	Equipment name
<u>X</u>	<u>      </u>	<u>1</u>	Specification section number
<u>X</u>	<u>      </u>	<u>1</u>	Contractor ID
<u>      </u>	<u>X</u>	<u>      </u>	Subcontractor ID
<u>X</u>	<u>      </u>	<u>8</u>	Purchase order data
<u>X</u>	<u>      </u>	<u>1</u>	Manufacturer ID
<u>X</u>	<u>      </u>	<u>1</u>	Service/parts supplier ID
<u>      </u>	<u>X</u>	<u>      </u>	Product List
<u>X</u>	<u>      </u>	<u>2</u>	Table of Contents
<u>      </u>	<u>X</u>	<u>      </u>	Tabbed Sections:
<u>X</u>	<u>      </u>	<u>11-13</u>	Pertinent data sheets
<u>X</u>	<u>      </u>	<u>12-13</u>	Annotated as needed
<u>X</u>	<u>      </u>	<u>Various</u>	Text:
<u>      </u>	<u>      </u>	<u>      </u>	Pertinent to project
<u>      </u>	<u>X</u>	<u>      </u>	Annotated
<u>      </u>	<u>      </u>	<u>      </u>	Drawings:
<u>X</u>	<u>      </u>	<u>62-64, 66</u>	Illustrate product and components
<u>      </u>	<u>X</u>	<u>      </u>	Control and flow diagrams
<u>      </u>	<u>      </u>	<u>      </u>	Special Information:
<u>      </u>	<u>X</u>	<u>      </u>	Interrelationships of equipment and components
<u>X</u>	<u>      </u>	<u>Various</u>	Instructions and procedures
<u>X</u>	<u>      </u>	<u>Various</u>	Instructions organized in
<u>X</u>	<u>      </u>	<u>Various</u>	Instructions in logical
<u>      </u>	<u>X</u>	<u>      </u>	Glossary
<u>      </u>	<u>X</u>	<u>      </u>	Warranty, Bond, Service Contract

O&M MANUAL SUBMITTAL CHECKLIST (Page 3 of 5)

MANUAL FOR MATERIALS AND FINISHES

<u>Provided</u>	<u>Not Applicable</u>	<u>Page No.</u>	
_____	<u>X</u>	_____	Building Products:
_____	<u>X</u>	_____	Product data
_____	<u>X</u>	_____	Catalog number
_____	<u>X</u>	_____	Size
_____	<u>X</u>	_____	Composition
_____	<u>X</u>	_____	Color and texture designations
_____	<u>X</u>	_____	Care and Maintenance Instructions
_____	<u>X</u>	_____	Recommended cleaning agents and methods
_____	<u>X</u>	_____	Cleaning precautions
_____	<u>X</u>	_____	Cleaning and maintenance schedule
_____	<u>X</u>	_____	Moisture Protection Products:
_____	<u>X</u>	_____	Product data listing
_____	<u>X</u>	_____	Chemical composition
_____	<u>X</u>	_____	Installation details
_____	<u>X</u>	_____	Inspection recommendations
_____	<u>X</u>	_____	Maintenance and repair
_____	<u>X</u>	_____	Additional Data as Required

O&M MANUAL SUBMITTAL CHECKLIST (Page 4 of 5)

MANUAL FOR EQUIPMENT AND SYSTEMS

<u>Provided</u>	<u>Not Applicable</u>	<u>Page No.</u>	
<u>X</u>	<u>      </u>	<u>12-13</u>	Description of Unit and Components:
<u>X</u>	<u>      </u>	<u>25</u>	Equipment functions
<u>X</u>	<u>      </u>	<u>11</u>	Normal operating characteristics
<u>      </u>	<u>X</u>	<u>      </u>	Limiting conditions
<u>      </u>	<u>X</u>	<u>      </u>	Performance curves
<u>X</u>	<u>      </u>	<u>11-13</u>	Engineering data
<u>      </u>	<u>X</u>	<u>      </u>	Test data
<u>X</u>	<u>      </u>	<u>71</u>	Replaceable parts list (with numbers)
<u>      </u>	<u>X</u>	<u>      </u>	P&ID numbers
<u>      </u>	<u>X</u>	<u>      </u>	Operating Procedures:
<u>X</u>	<u>      </u>	<u>46-47</u>	Startup
<u>      </u>	<u>X</u>	<u>      </u>	Break-in
<u>X</u>	<u>      </u>	<u>48</u>	Routine/normal operation
<u>      </u>	<u>X</u>	<u>      </u>	Regulation and control
<u>X</u>	<u>      </u>	<u>46, 47, 50</u>	Stopping and shutdown
<u>      </u>	<u>X</u>	<u>      </u>	Emergency
<u>      </u>	<u>X</u>	<u>      </u>	Seasonal operation
<u>      </u>	<u>X</u>	<u>      </u>	Special instructions
<u>      </u>	<u>      </u>	<u>      </u>	Maintenance Procedures:
<u>X</u>	<u>      </u>	<u>Various</u>	Routine/normal instructions
<u>X</u>	<u>      </u>	<u>57-60</u>	Troubleshooting guide
<u>X</u>	<u>      </u>	<u>55-56</u>	Disassembly/reassembly/repair
<u>      </u>	<u>X</u>	<u>      </u>	Alignment/adjusting/balancing
<u>      </u>	<u>X</u>	<u>      </u>	Servicing and Lubrication:
<u>      </u>	<u>X</u>	<u>      </u>	List of lubricants
<u>      </u>	<u>X</u>	<u>      </u>	Lubrication schedule
<u>X</u>	<u>      </u>	<u>51-53</u>	Maintenance schedule
<u>X</u>	<u>      </u>	<u>Various</u>	Safety Precautions/Features
<u>      </u>	<u>X</u>	<u>      </u>	Sequence of Operation of Controls
<u>X</u>	<u>      </u>	<u>63, 64, 66, 70</u>	Assembly Drawings
<u>X</u>	<u>      </u>	<u>62-70</u>	Parts List and Illustrations:
<u>X</u>	<u>      </u>	<u>54</u>	Predicted life
<u>X</u>	<u>      </u>	<u>71</u>	Recommended spare parts list and prices
<u>      </u>	<u>X</u>	<u>      </u>	Control Diagrams/Schematics
<u>      </u>	<u>X</u>	<u>      </u>	Bill of Materials

O&M MANUAL SUBMITTAL CHECKLIST (Page 5 of 5)

<u>Provided</u>	<u>Not Applicable</u>	<u>Page No.</u>	
<u>  X  </u>	<u>      </u>	<u> 8-10 </u>	Completed Equipment Data Form per Specification
<u>      </u>	<u>  X  </u>	<u>      </u>	Valves
<u>  X  </u>	<u>      </u>	<u>12-13</u>	Catalog Cuts and Tag Numbers
<u>  X  </u>	<u>      </u>	<u>Various</u>	Maintenance Instructions
<u>      </u>	<u>  X  </u>	<u>      </u>	Panelboard Directories:
<u>      </u>	<u>  X  </u>	<u>      </u>	Electrical
<u>      </u>	<u>  X  </u>	<u>      </u>	Controls
<u>      </u>	<u>  X  </u>	<u>      </u>	Communications
<u>      </u>	<u>  X  </u>	<u>      </u>	Instrumentation Loops:
<u>      </u>	<u>  X  </u>	<u>      </u>	Diagrams
<u>      </u>	<u>  X  </u>	<u>      </u>	Components list each circuit/loop
<u>      </u>	<u>  X  </u>	<u>      </u>	Additional Data As Required

EQUIPMENT DATA FORM (Page 1 of 3)

PROJECT NAME Des Plaines River WRF

CONTRACT NO. Phases 2B and 3 Improvements

CONTRACTOR Williams Brothers Construction, Inc.

EQUIPMENT NO. \_\_\_\_\_

DESCRIPTION Dry Silo Bin Vents

LOCATION 800 Krause Drive, Buffalo Grove, IL 60089

MANUFACTURER Coperion K-tron

PURCHASED FROM Coperion K-tron Silina, Inc. PURCHASE DATE May 15, 2017

VENDOR ORDER NO. \_\_\_\_\_ PURCHASE PRICE \$12,340

LOCAL SUPPLIER Coperion K-tron Silina, Inc. PHONE 785 825-1611

ADDRESS 606 North Front Street, Salina, KS 67401

MODEL NO. PF25214-257.1 SHIPPING WT/UNIT \_\_\_\_\_

NO. OF UNITS Three (3) SERIAL NOS. \_\_\_\_\_

NAMEPLATE DATA

<u>ELECTRIC MOTOR</u>	<u>PUMP/HVAC UNIT</u>	<u>DRIVE/REDUCER</u>	<u>OTHER (I&amp;C)</u>
MANUFACTURER:	MANUFACTURER:	MANUFACTURER:	MANUFACTURER:
<u>N/A</u>	<u>N/A</u>	<u>N/A</u>	<u>N/A</u>
TYPE: <input type="checkbox"/> AC <input type="checkbox"/> DC	TYPE_____	TYPE: <input type="checkbox"/> GEAR	TYPE_____
HP_____	SIZE_____	<input type="checkbox"/> V-BELT	SIZE_____
RPM_____	CAPACITY_____	<input type="checkbox"/> CHAIN	CAPACITY_____
VOLTAGE_____	PRESSURE_____	<input type="checkbox"/> VARIDRIVE	
AMPERAGE_____	ROTATION_____	SERVICE FACTOR_____	RANGE_____
PHASE_____	IMPELLER:	RATIO_____	
	SIZE_____		
FRAME_____	MATERIAL_____		

EQUIPMENT DATA FORM (Page 2 of 3)

MAINTENANCE SUMMARY

EQUIPMENT NO. \_\_\_\_\_

DESCRIPTION Dry Silo Bin Vents

MAINTENANCE OPERATION

List briefly each maintenance operation required and refer to specific information in Manufacturer's Maintenance Manual, if applicable. Refer by symbol to "Lubricant List" for Lubrication Operation.

Eliminate dust accumulation more than 5 mm [0.2 in] through cleaning

Check convey and vacuum line mechanical connections for tightness.

Check seal rings for damage

Check safety symbols at the equipment for legibility and completeness.

Check the compressed air settings

Empty condensed water separator

Change filters

Visually check all electrical cables and connections.

Electrical inspection with test protocol by an electrician (insulation inspection, voltage inspection, protective conductor, protection against residual voltages)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

FREQUENCY

List required frequency of each maintenance operation.

Check pressure regulator

Check pressure regulator

Check pressure regulator

Check pressure regulator

Daily

Monthly

Every 6 months or as required

Daily

Every 4 years

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## LUBRICANT/RECOMMENDED SPARE PARTS LIST

EQUIPMENT NO. \_\_\_\_\_

DESCRIPTION Dry Silo Bin Vents**LUBRICANT LIST**

<u>LUBRICANT REFERENCE SYMBOL</u>	<u>LUBRICANT TYPE (MILITARY STANDARD)</u>	<u>RECOMMENDED AND MANUFACTURER</u>
List symbol in "maintenance operation"	List general lubricant type	List specific lubricant name, viscosity and manufacturer
<u>None Required</u>	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

**RECOMMENDED SPARE PARTS LIST**

<u>PART NO.</u>	<u>DESCRIPTION</u>	<u>UNIT</u>	<u>QUANTITY</u>	<u>UNIT COST</u>
<u>See Page</u> <u>for Spare Parts List</u>	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

NOTE: Identify parts provided by this Contract with two asterisks.

## ADDITIONAL DATA AND REMARKS

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**Komline-Sanderson**

12 Holland Av  
908-234-1000

Peapack, NJ 07977-0257  
Fax: 908-234-9487  
www.komline.com

Des Plaines River WRF  
Lake County, IL

#### SILO BIN VENTS

Specification Section: 11650H Paragraph 2.4I MODULAR CARTRIDGE BIN VENT

Manufacturer: Coperion K-Tron  
Part No: PF25214-257.1  
Type: Removable cartridge filter  
Filter Area: 100 square feet  
Filter Material: Washable Polyester  
Cleaning Mechanism: Pulse Jet with Compressed Gas Accumulator Tank  
Cleaning Medium: Nitrogen, 1.5 CFM (90 cu ft/hr) at 80-100 psig

Materials of Construction:

Housing:	304SS
Plenum:	304SS
End Caps:	304SS
Accumulator:	304SS

Mounting: 20" diameter flange to mate with silo deck flange  
¼" thick silicone gasket and 18-8 SS mounting hardware provided by K-S

Exceptions to Specifications: 24V DC solenoid not included with bin vent.  
Nitrogen flow controlled by 120V AC solenoids FV-12-5-1, FV-12-8-1, FV-12-11-1 provided by K-S and installed by Contractor. Nitrogen solenoids controlled via 60-LCP-11-1.

## Application

The Modular Cartridge Bin Vent provides excellent air filtration of fine airborne particles from within a storage tank and releases clean air to the atmosphere. While material is pneumatically conveyed into a storage tank, fine particles and air are efficiently separated by the unit's large cartridge filter. This enables clean air to pass from the tank out to the atmosphere. Reverse jet cleaning from a compressed air accumulator pulses the cartridge filter, dislodging any fines and returning them to the storage tank.

## Design

The Modular Cartridge Bin Vent is maintenance friendly. Standard materials of construction include carbon steel enamel coating or stainless steel material contact areas. Stainless steel construction is available for abrasive, corrosive, and food-grade applications. Mounting on a standard 508 mm [20 in] diameter tank deck flange, the small modular unit is inexpensive and easy to install. The unit's single cartridge filter is constructed of tough, washable polyester for efficient filtration. The cartridge filter hangs vertically and has shallow, open pleats for efficient dust release, even with difficult materials. Each unit can filter 5.7 - 11.3 m<sup>3</sup>/min [200 - 400 ft<sup>3</sup>/min] of air, depending upon the application. Quick-release clamps allow easy access to the cartridge filter. The plenum features a built-in weather hood and specially designed diffuser which enables each air pulse to clean the entire filter. Unlike other bin vents, no exhaust fan is required.

## Technical Data

### Standard Features

- Available in ~~paint~~ **PAINTED RAL 7035 gray carbon steel or 1.4303 (AISI 304) stainless steel construction**
- Simple no-tool tank deck maintenance**
- Large pulse-cleaned cartridge filter with 9.3 m<sup>2</sup> [100 ft<sup>2</sup>] cloth area
- 2.55 m<sup>3</sup>/hr [90 ft<sup>3</sup>/hr] of clean, dry compressed air required at 5.5 - 6.9 Bar [80 - 100 PSIG]
- Built in weather hood**
- Add additional units for greater filtration
- Cost effective and easy to install
- Quick-release clamps for easy cleaning and maintenance**
- CE compliant**

### ~~Pulse-Clean Control Panel (required, but sold separately)~~

- ~~Regulates cleaning of the bin vent cartridge filter~~
- ~~Easy frequency and pulse duration adjustment~~
- ~~Spare timer and solenoid included to accommodate an additional Modular Cartridge Bin Vent~~
- ~~When multiple units are used, the controller pulses one unit at a time, leaving the remaining units on-line for filtration~~
- ~~Cleaning timer control panel with IP65 (NEMA 4) enclosure and 24 VDC or 120 VAC operation, single-phase, 50/60 Hz~~
- ~~Includes all fittings and tubing required to connect to the Modular Cartridge Bin Vent filters~~
- ~~NEC Hazardous Location: Class 2, Div. 2, Groups E, F & G~~

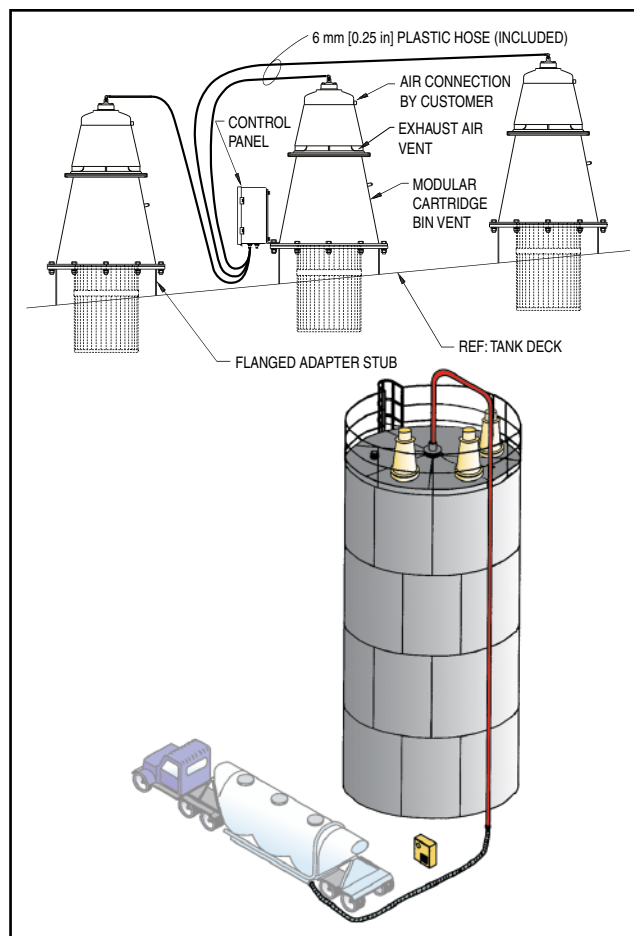
## ~~Options~~

- ~~Flanged adapter stubs (allows the Modular Cartridge Bin Vent to be mounted to the top of an existing storage tank)~~
- ~~PTFE coated cartridges~~
- ~~Oversized accumulator~~
- ~~Explosion-proof NEMA 7 or 9 construction~~
- ~~NEC Hazardous Location: Class 1, Div. 1, Groups C & D~~
- ~~ATEX versions available~~

## SILO BIN VENTS-ONE PER SILO

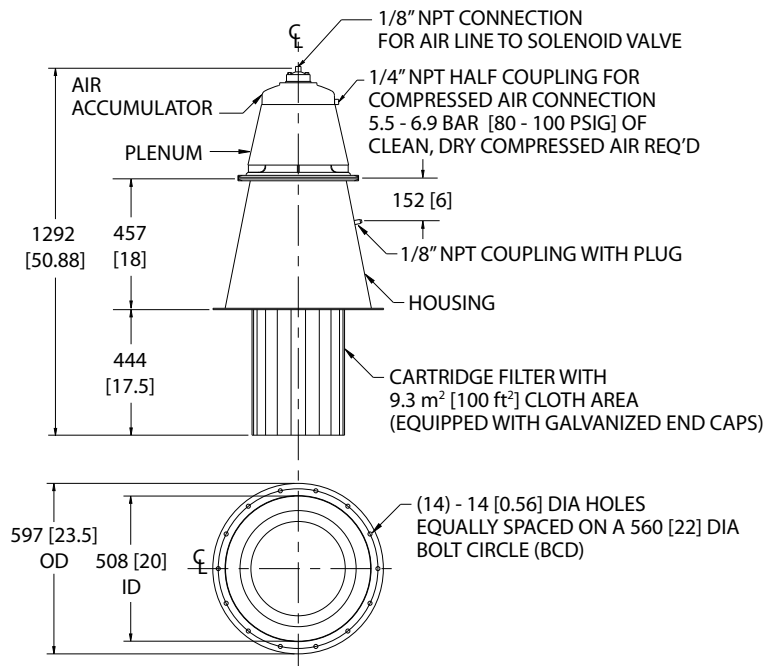


## Example of a Modular Cartridge Bin Vent installation in a PD truck unloading system



### Dimensions of Modular Cartridge Bin Vent

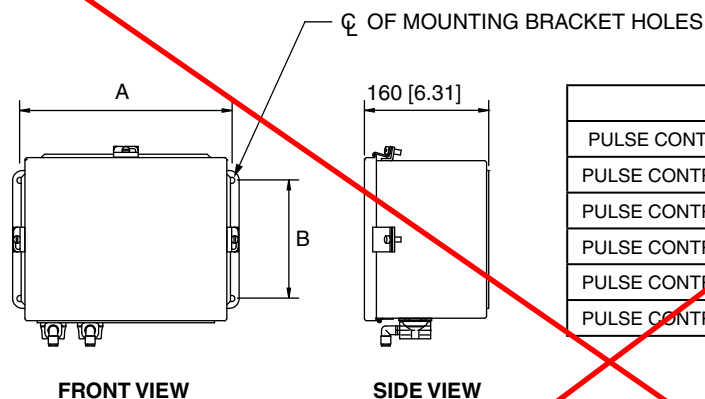
mm [in]



Solenoid Valve Control via 60-LCP-11-1

### Dimensions of Pulse-Clean Control Panel (required, but sold separately)

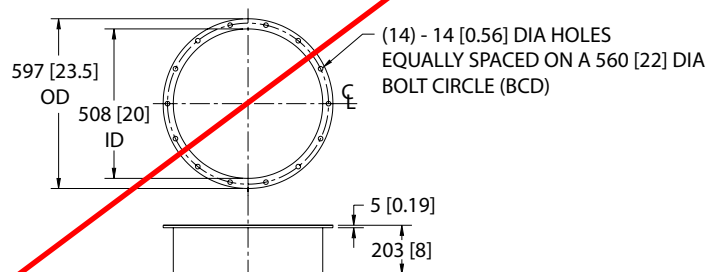
mm [in]



DESCRIPTION	A	B
PULSE CONTROLLER FOR 1 MODULAR BIN VENTS	260 [10.25]	209 [8.25]
PULSE CONTROLLER FOR 2 MODULAR BIN VENTS	260 [10.25]	209 [8.25]
PULSE CONTROLLER FOR 3 MODULAR BIN VENTS	260 [10.25]	209 [8.25]
PULSE CONTROLLER FOR 4 MODULAR BIN VENTS	311 [12.25]	311 [12.25]
PULSE CONTROLLER FOR 5 MODULAR BIN VENTS	311 [12.25]	311 [12.25]
PULSE CONTROLLER FOR 6 MODULAR BIN VENTS	412 [16.25]	362 [14.25]

### Dimensions of Flanged Adapter Stubs (optional, sold separately)

mm [in]



**Note:** For more information on these products consult your K-Tron Premier Sales Representative.

**Caution:** Measurements are for general reference only. Please consult dimensional drawing for exact measurements.

# OPERATING AND MAINTENANCE INSTRUCTIONS

## Modular Cartridge Bin Vent



Read this document prior to operating the device.

This document contains all safety and warning notes.

Original operating instructions

1290034602-EN Rev. 1.1.0

## Service

If you need assistance, please call your local service center or:

### **Coperion K-Tron Salina, Inc.**

606 North Front Street  
Salina, KS 67401 USA

Tel. 001 (0) 785 / 825 1611

Fax 001 (0) 785 / 825 8759

### **Coperion K-Tron Pitman, Inc.**

590 Woodbury Glassboro Road  
Sewell, NJ 08080 USA

Tel. 001 (0) 856 / 589 0500

Fax 001 (0) 856 / 256 3281

### **Coperion K-Tron (Schweiz) GmbH**

Lenzhardweg 43/45  
CH-5702 Niederlenz  
Switzerland

Tel. 0041 (0) 62 / 885 7171

Fax 0041 (0) 62 / 885 7180

## **Web:**

[www.coperionktron.com](http://www.coperionktron.com)

## **Before you call...**

- ⇒ Do you have alarm displays? Can you eliminate their causes?
- ⇒ Have you modified part of the system, product or operating mode?
- ⇒ Have you tried to eliminate the fault in accordance with the operating instructions?
- ⇒ Note down the project or job number. This can be found at the machine or in the project manual.
- Example: 0400545

## **Using the manual:**

- ⇒ This arrow identifies an individual action.
- 1. Numbers identify a sequence of actions which have to be executed step-by-step.
- ▲ This symbol identifies a general safety note.



Reference to another manual.



Important information.



This symbol indicates that tools are required for the following task.



Specifies where information or a situation must be checked.

Doc. No.: 1290034602-EN

Date: 2015/Jul/22

Original: 1290034602-EN

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# 1 SAFETY NOTES



Installation, commissioning and programming of the specified equipment should only be undertaken by qualified personnel.

## 1.1 Safety Symbols Definitions



▲ DANGER indicates a extremely hazardous situation which, if not avoided, could lead to heavy bodily injury or to death.



▲ WARNING indicates a potentially hazardous situation which, if not avoided, could lead to heavy bodily injury or to death.



▲ CAUTION with safety alert indicates a potentially hazardous situation which, if not avoided, could lead to light bodily injuries.



▲ NOTICE indicates a potentially hazardous situation which, if not avoided, may result in property damage.



▲ The safety alert symbol is used to alert to the potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.



### 1.1.1 Ex-Protection Icon



Follow the safety notes and warnings for devices meant for use in potentially explosive areas.

### 1.1.2 Electrical Hazard Icon



This sign indicates an electrical hazard.

### 1.1.3 Ground Icon



This sign indicates that a ground/PE connection is required.

### 1.1.4 No Hands Icon



Do not place hands or other body parts into moving parts or machine.

### 1.1.5 Power Icon



Disconnect power and lock out/tag out equipment before performing any maintenance to prevent against any unexpected start up.

### 1.1.6 Ear Protection Icon



Insure that proper ear protection is worn at all times when near this equipment.

### 1.1.7 Pinch Icon



Pinch Point - keep hands clear.

### 1.1.8 Restricted Access Icon



No access is allowed for persons unauthorized to work on equipment. Before performing any maintenance be sure that you know and understand how the equipment operates. Before removing the guard insure that the equipment is locked out.

### 1.1.9 Manual Instructions Icon



Read the Owner's manual for all instructions.

## 1.2 Special Risks of the Filter



### **DANGER**

#### **Mortal danger as a result of live wires**

- ▲ The conveying device may only be connected by qualified electricians.



### **CAUTION**

#### **Filter cleaning poses a noise hazard**

- ▲ Ear protection must be worn.



### **CAUTION**

#### **Risk posed by dust ejection**

- ▲ Dust ejection may result in breathing problems. The seals must be checked on a regular basis and replaced where necessary.

## 1.3 Proper Use



- ▲ Only operate the device when it has been mounted and when all open links have been connected.
- ▲ Never convey materials which may cause a chemical reaction with the materials of the device.
- ▲ Do not convey moist product.
- ▲ When dangerous materials are being processed, the safety instructions for handling these materials must be adhered to as well.
- ▲ Only operate the device in accordance with the specified technical data.
- ▲ Do not use the equipment in a manner not intended by the manufacturer.
- ▲ Manipulation and safety-related technical modifications are forbidden.
- ▲ Never use the device to process explosive gas or air gas mix.
- ▲ Products with a minimum ignition energy MIE lower than 10 mJ at room temperature may not be transported.
- ▲ Eliminate sources of ignition, avoid the creation of dust and ensure regular cleaning.

## 1.4 Responsibilities of the Owner



- ▲ Ensure that only qualified and trained personnel work with the system.
- ▲ Establish personnel responsibilities for operation and maintenance.
- ▲ Ensure that the personnel has read and understood the operating instructions to all installation components, particularly this section "Safety notes".
- ▲ The operating company must have damaged or missing components replaced immediately.
- ▲ The intake of alien materials (metal parts, stones) must be prevented by the operator.
- ▲ The plant owner is responsible for compliance with legally prescribed accident prevention and safety regulations.

## 1.5 Organizational Measures



- ▲ Always keep the operating instructions within easy reach of the device. Ensure that they are always complete and legible.
- ▲ Observe the safety notes for the connected equipment.
- ▲ In addition to the operating instructions, always comply with generally prescribed safety regulations governing accident prevention and environmental safety.

## 1.6 Safety-Conscious Work



- ▲ Read the operating instructions, in particular these safety notes, and follow these instructions.
- ▲ Ensure that only authorized personnel enter the working and danger area.
- ▲ Any changes (including changes in the operational behaviour) which affect safety must be reported immediately to the responsible member of the staff.
- ▲ Always keep safety in mind while working.
- ▲ When operating any valve to check its action, be careful not to have hands near any open ports.
- ▲ Before any work is carried out on components, the main switch must be switched off and the device depressurized.

## 1.7 Safety Devices



- ▲ Never alter the mechanical safety devices or the electrical control system for the safety devices.
- ▲ Only operate equipment with all safety devices in place.
- ▲ Check that all safety devices operate properly every day.
- ▲ Never open or remove covers or hoods while the equipment is in operation.
- ▲ Do not modify the electrical safety devices, for example fuses. Increased risk of accident.
- ▲ Only use the specified fuse types when replacing fuses.
- ▲ Replace damaged cable joints and connections immediately.

## 1.8 Additional Equipment



- ▲ Modifications to the equipment are prohibited.
- ▲ The operator is responsible for complying with all safety regulations related to interoperation with any additional equipment.

## 1.9 Customer Service and Repairs



- ▲ Repairs should only be performed by the Coperion K-Tron customer service branch responsible or by specialised staff that has been trained by Coperion K-Tron.

Customer service address is found on the project manual.

Only use original Coperion K-Tron parts.

## 1.10 Shut-Down Procedure



- ▲ The operator is responsible for the proper removal and disposal of the equipment from service.

## 2 APPLICATION

### 2.1 Function



**Fig. 2.1** Modular cartridge bin vent

The Modular Cartridge Bin Vent is a filter device used to separate dust particles from exhaust gas exiting the vessel. It is equipped with automatic filter cleaning.

When material is pneumatically conveyed into a vessel most of the material drops out of suspension. The particles in the dust laden air are trapped in the filter element while gas is allowed to vent out of the vessel. The product remains in the vessel below and clean air exhausts through the Modular Cartridge Bin Vent, out the vessel, to the atmosphere.

### 2.2 Design



**Fig. 2.2** Modular cartridge static bin vent

The filter is cleaned by reverse jet cleaning from a compressed air accumulator. Sequentially timed bursts of compressed air, controlled by solenoid valves and timer control board creates a momentary reverse flow of gas and shakes the filter element. This action dislodges the trapped particles back into material below. Only a single modular bin vent is pulsed at a time, leaving the remaining bin vents on-line. The interval between pulsing is adjustable to ensure optimal filter element cleaning.

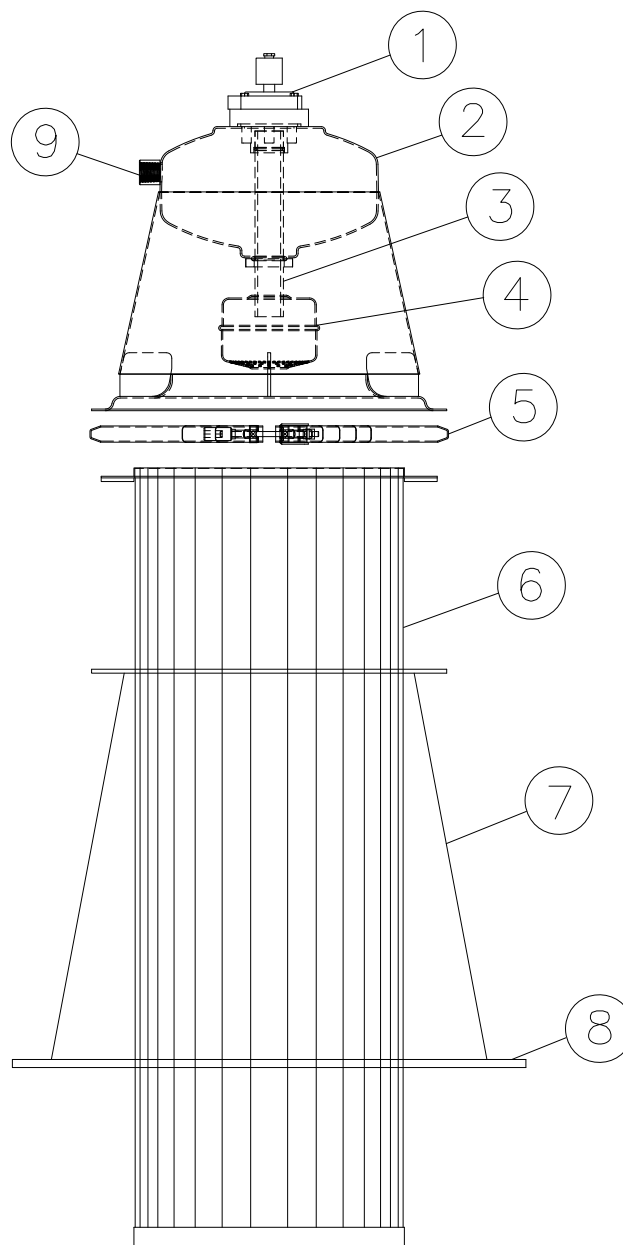
To get access to the filter, the V-clamp must be removed and the plenum (top filter housing) must be lifted.

The air pulse cleaning of the filter is regulated by the timer control panel. The timer allows easy adjustment of the frequency and duration of each pulse and a display shows which element row is currently being cleaned. All solenoids for pulse cleaning are located in the panel.

The filter can be equipped with an optional pressure differential indicator. The gauge measures the difference in pressure between the filter housing and the clean air plenum, informing the operator of the effectiveness of the filter cleaning system.

## 2.3 Components of the Filter Receiver

- (1) Diaphragm valve with coil  
(if equipped)
- (2) Plenum
- (3) Pulse pipe
- (4) Silencer
- (5) V-clamp
- (6) Cartridge filter
- (7) Housing
- (8) Flange, 500mm [20 in.]
- (9) Pipe connection for in plant  
compressed air



**Fig. 2.3** Components



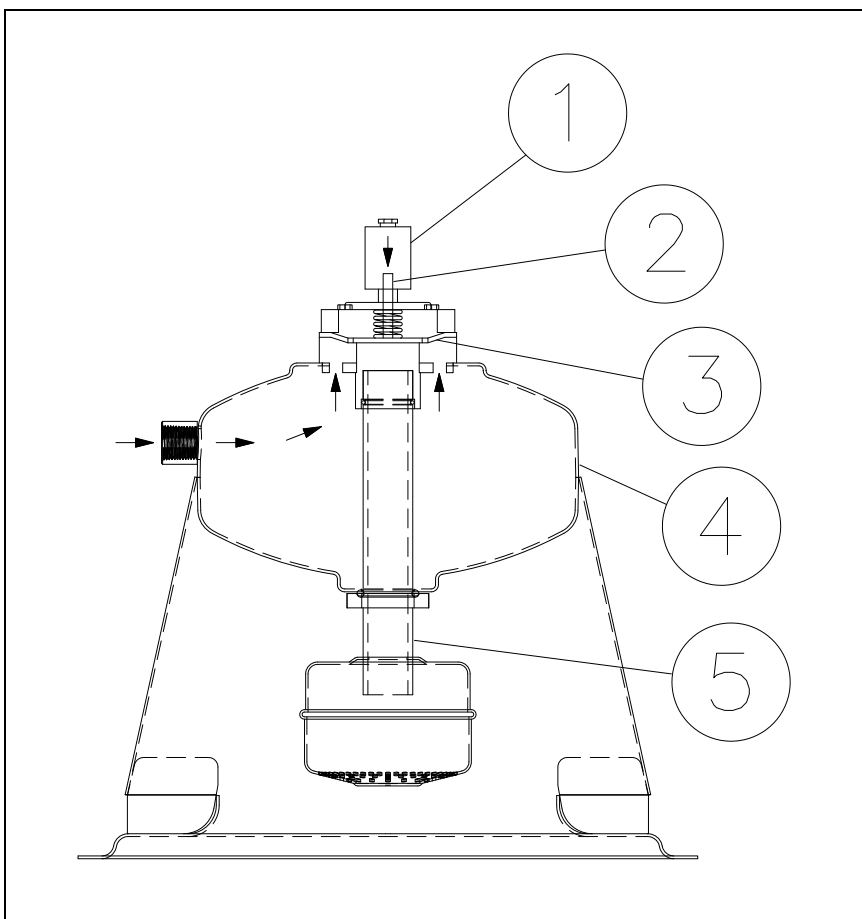
## 2.4 Functioning of the Air Pulsing System

Compressed air passes from the air accumulator into the diaphragm valve. Each diaphragm valve includes an electromagnetic coil that lifts a piston to open and close the diaphragm. When the diaphragm is open, air rushes from the air accumulator, through the pulse pipe, and down into the filter.

### 2.4.1 Closed (Off Time)

The period of time in which the solenoid is de-energized is the OFF time.

- (1) Solenoid Coil
- (2) Solenoid Piston
- (3) Diaphragm
- (4) Air Accumulator
- (5) Pulse Pipe



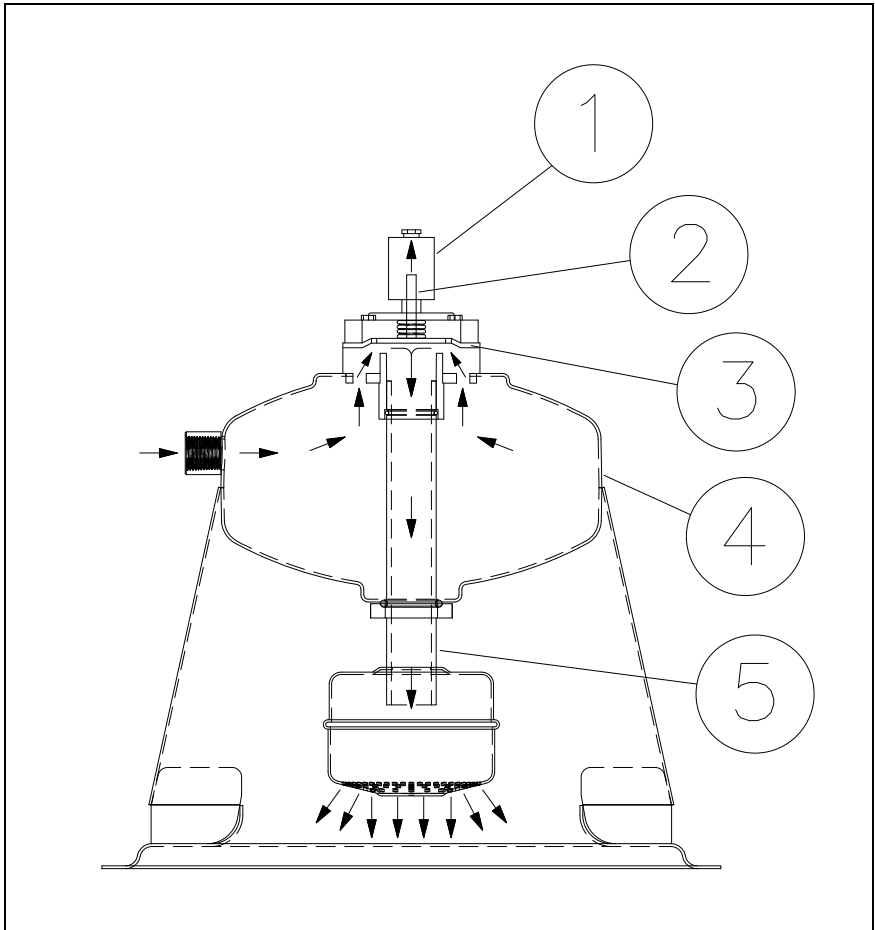
**Fig. 2.4** OFF time of the pulsing system

### 2.4.2 Open (On Time)

When the solenoid coil is energized by the timer board, the solenoid armature lifts the piston which moves the diaphragm into the open position. A pulse of air then passes from the air accumulator into the pulse-jet pipe, cleaning the filter. This period of time in which the solenoid is energized is the ON time.


When the solenoid coil is de-energized, the diaphragm valve is allowed to close and pressure again builds in the air accumulator.




- (1) Solenoid Coil
- (2) Solenoid Piston
- (3) Diaphragm
- (4) Air Accumulator
- (5) Pulse Pipe

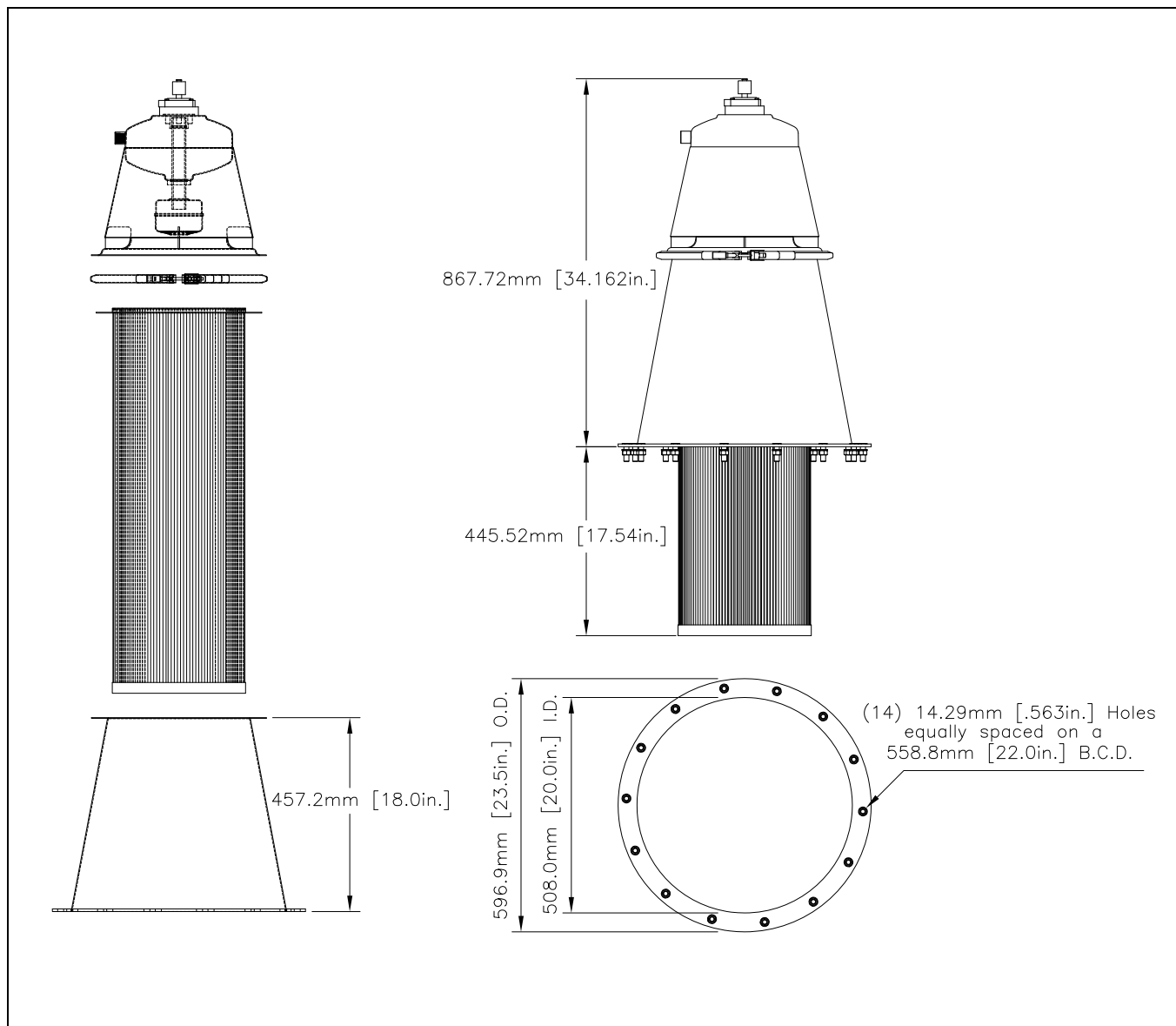


**Fig. 2.5** ON time of the pulsing system

### 3 TECHNICAL DATA

Manufacturer	Coperion K-Tron
Description	Modular Cartridge Bin Vent
Conformity	 (For detailed descriptions, see the declaration of conformity or the name plate)
Compressed air connections	Clean, dry and oil-free
Max. pressure	6.9 bar [100 PSI]
Min. pressure	5.5 bar [80 PSI]
Noise level	< 70 dB (A)
Capacity	Depending on configuration
Weight	Depending on configuration
Dimensions	See dimensional drawings in system project manual
Materials of constructions: Housing  Filter material Seals	Carbon Steel or Stainless steel DIN material No. 1.4301, AISI 304  Fine Denier, Spunbond Polyester cartridge (Optional) PTFE Membrane treatment Natural rubber, white, food quality rubber (FDA) For more information see project manual
Operating temperature range	-10 to +50°C (14 to 122°F)
Power supply Pulse clean control panel	24 VDC
<b>Table page 1 of 2</b>	

<p><b>Marking</b></p> <p>(1) Description</p> <p>(2) Serial number</p> <p>(3) Ambient temperature</p> <p>(4) Product temperature</p> <p>(5) Model</p> <p>(6) ATEX label</p>	<div>  <p>Country of Origin: United States of America</p> <p>Typ/Type <input type="text"/></p> <p>Ident.-No. <input type="text"/></p> <p>Ambient temperature <input type="text"/></p> <p>Material temperature <input type="text"/></p> <p>Jahr/Year <input type="text"/></p> <p>Kennzeichnung / Marking <input type="text"/></p> <p> </p> </div> <div> <p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>5</p> <p>6</p> </div>
<p><b>Table page 2 of 2</b></p>	



**Fig. 3.1** Dimensions

## 4 TRANSPORT, STORAGE and DISPOSAL

### 4.1 Transport



See delivery note for weight information.

#### 4.1.1 Unpacking

1. Check whether the supplied goods are complete and check them for transport damage.
2. Report any damage immediately to shipper and to Coperion K-Tron.
3. Dispose of packaging material according to the local regulations.

#### 4.1.2 Lifting

### **⚠ DANGER**

#### **Risk posed by falling transport material**

- ▲ Only have the equipment transported by authorized and qualified personnel.
- ▲ Select the lifting gear in accordance with the total weight to be transported.
- ▲ Fasten the lifting gear as indicated on the diagram.
- ▲ Do not stand under suspended loads.

- 
- ⇒ Make sure all clamps are securely fastened.
  - ⇒ Protect the cable ducts and air pipes etc. from being damaged before attaching the slings of the hoisting equipment.

1. Loop the lifting sling (1) below the V-clamp (2) and secure it.
2. Lift the device absolute vertical.



**Fig. 4.1** Transport

## 4.2 Storage

### NOTICE

#### Property damage caused by improper storage

▲ The device must be properly stored.

- Empty and clean the device and add a material safety data sheet (MSDS), indicating which product was last transported.
- Seal all openings with blank flanges, blank stoppers or plastic covers.
- The warehouse must fulfil the following conditions:
  - Dry
  - Frost-free

## 4.3 Disposal

### ⚠ WARNING



#### Risk of injury and poisoning by the transport medium

- ▲ Personal protective clothing is to be worn for all work on the device.
- ▲ The safety instructions for handling these materials must be adhered to.

Dispose of the device in accordance with the local regulations.



## 5 INSTALLATION

### **DANGER**



#### **Risk posed by falling device**

- ▲ Only have the device transported by authorized and qualified personnel.
- ▲ Select the lifting gear in accordance with the total weight to be transported.
- ▲ Do not stand under suspended loads.

### **CAUTION**



#### **No Hands Icon**

Improper connection may result in bruising.  
The device may only be operated once it has been installed or fitted.



- Where inlets/outlets are left open, the pipe sections or other fittings, e.g. grids, must be long enough to ensure that moving parts cannot be touched.
- The device must be set up in such a way that there is sufficient room for maintenance work.

### 5.1 Prepare the Installation Site



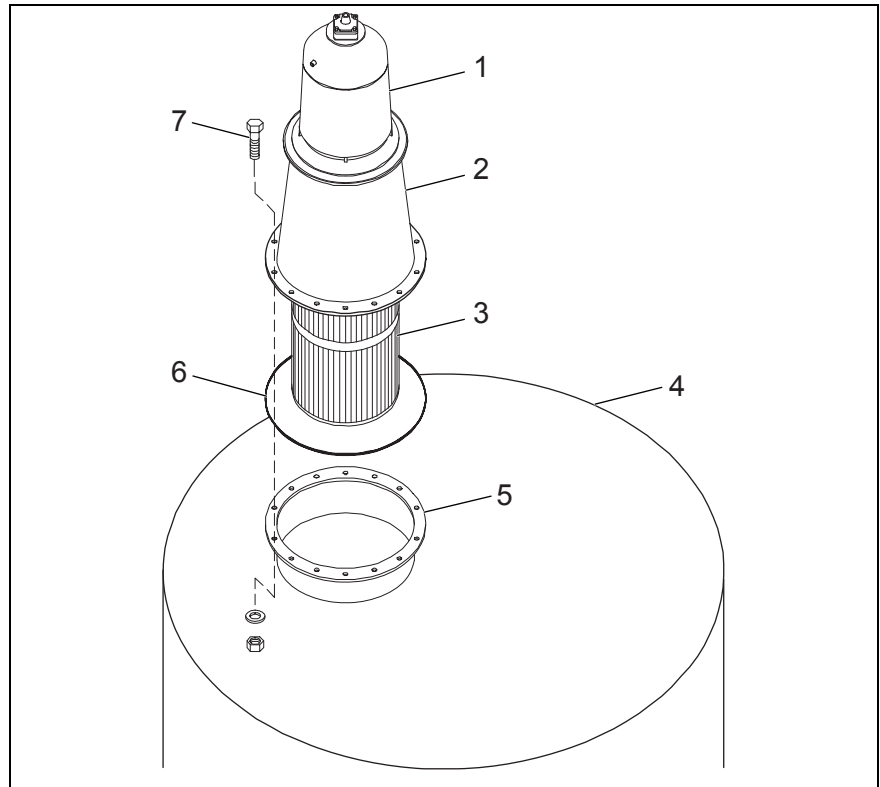
#### **Ensure that the installation site meets the following conditions:**

- The device must be freely accessible from all sides.
- There must be sufficient space for installing/removing the pipes, as well as maintenance and repair work.
- Even
- Clean (no oil, dust or other pollutants)
- The surface must be able to carry the inherent weight of the device and all operating forces.
- The stability of the device must be ensured.

## 5.2 Modular Cartridge Bin Vent Mounting

1. The Modular Cartridge Bin Vent requires a standard 20-inch diameter tank flange for mounting. If more than one bin vent is required, the flanges should be located 51 to 76 cm [20 to 30 inches] from the side of the tank and about 76 cm [30 inches] apart (see Fig. 5.1).

- (1) Plenum with air accumulator
- (2) Housing
- (3) Cartridge filter
- (4) Tank
- (5) 20" adapter stub
- (6) Sealant
- (7) Bolt, lock washer, nut



**Fig. 5.1** Installing the filter device onto the tank

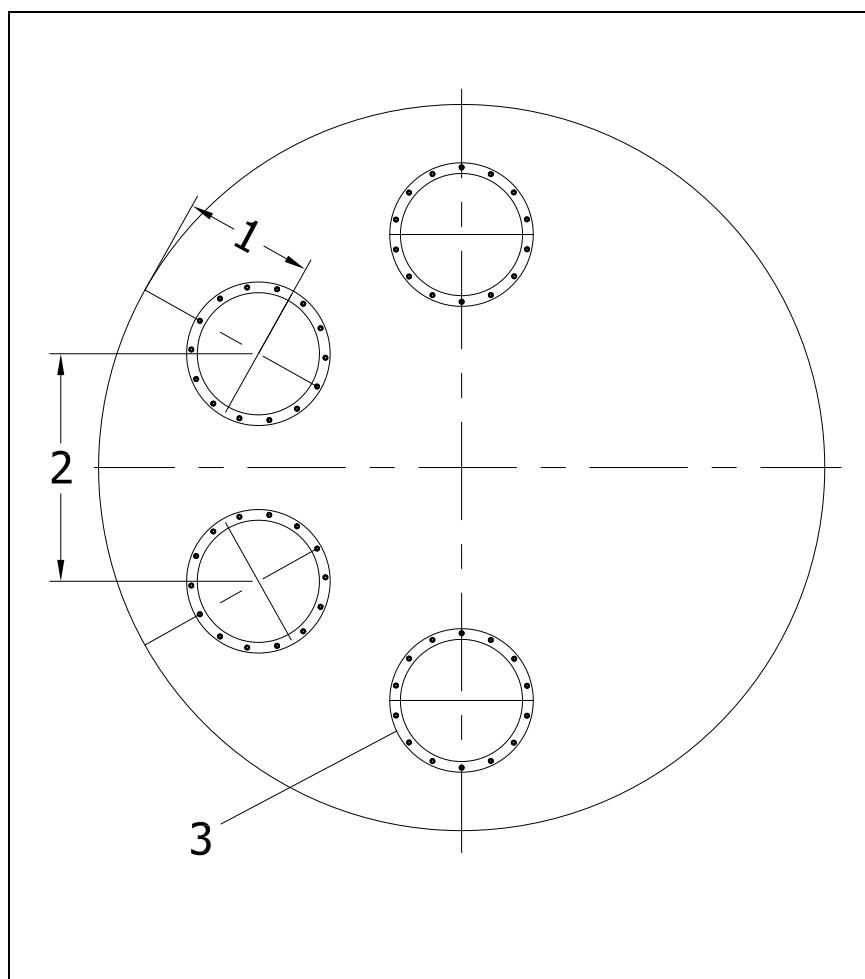
2. If the tank is not equipped with the correct mounting flange(s), mount the adapter stub(s) on the tank, as described in step 1. Ensuring that the top flange(s) are levelled (see Fig. 5.2). Weld continuously to prevent air loss. Adapter stubs are available from Coperion K-Tron Spare Parts Department.

### NOTICE

#### Damage of the system

Abide the correct spacings.

- (1)  $61 \pm 15$  cm [ $24'' \pm 6''$ ] from edge of tank to center line of filter
- (2) 76,2 cm [30"] spacing between units
- (3) Standard 50.8 cm [20"] diameter tank flanges with 14 or 18 holes .48cm [ $3/16''$ ] diameter equally spaced on a 55.9 cm [22"] diameter bolt circle



**Fig. 5.2** Tank deck

## 5.3 Cartridge Filter Installation

1. Mount the bin vent's housing to the tank's flange, using the sealant provided by Coperion K-Tron (see [Fig. 5.1](#)). Tighten the nuts to ensure a tight seal. Make sure the sealant provides a good seal between the tank and the flange of the housing.
2. Set the cartridge filter element down into the housing and tank, being careful not to damage the pleats.
3. Place the plenum assembly on top of the cartridge filter (a gasket is not required above the cartridge filter). Then, secure the plenum to the rest of the unit, using the V-clamp.

## 5.4 Timer Control Panel Installing

1. Install the timer control panel and electrical as shown in [Fig. 5.3](#).

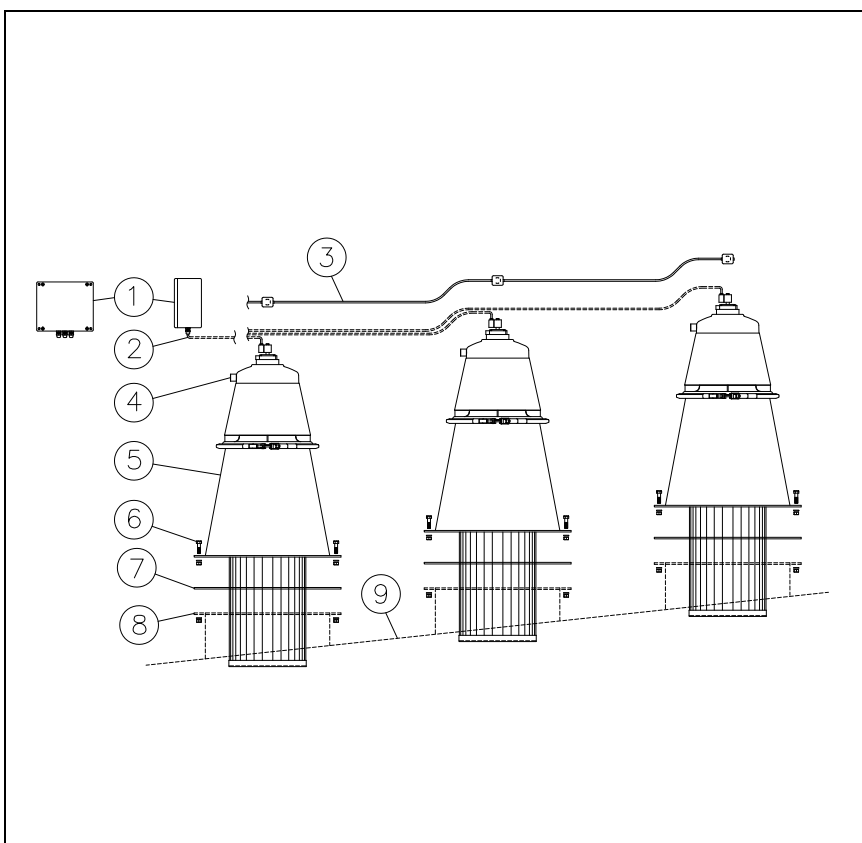
**i**

- For 24VDC units consider wire size and voltage drop for panel installation location. Longer lengths will create voltage drop and the solenoid valves may not function properly below 23.3 VDC.

**i**

- One timer control panel is used to control all the bin vent units on a tank.

- (1) Timer control panel
- (2) Control wiring, typically by customer
- (3) Optional Series wiring cable
- (4) 5.5 - 6.9 bar [800-100 PSIG] NPT air connection by customer (typical)
- (5) Modular Cartridge Bin Vent
- (6) Bolt, lock washer & nut
- (7) Sealant
- (8) Flanged adapter stub
- (9) Tank deck



**Fig. 5.3** Installing the timer control panel

## 5.5 Electrical Connection

### **DANGER**



#### **Mortal danger as a result of live wires**

- ▲ The conveying device may only be connected by qualified electricians.
  - ▲ Observe the local regulations.
- 



Connect the ground connection to a low-impedance equipotential bonding ( $\leq 0.1 \text{ W}$ ), see the grounding information on the device.



Provide a lockable main switch to disconnect the main power supply from the conveying device.



Carefully follow all wiring and shielding procedures as indicated on the provided wiring diagrams and operating instructions of the controls.

## 5.6 Connect Power Source to Timer Board

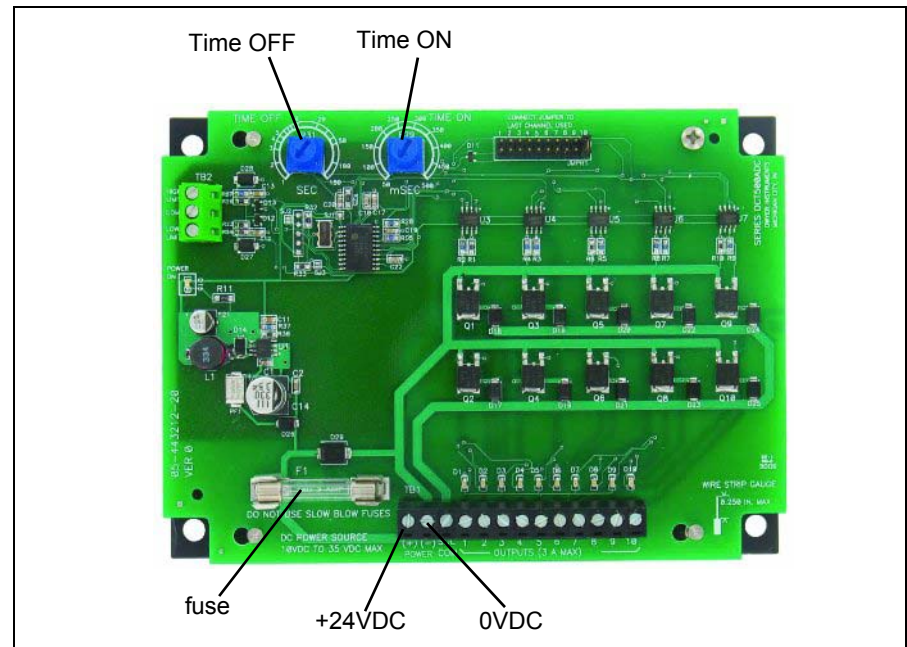
1. Connect the power source to terminals +24VDC and 0VDC of the timer board (see Fig. 5.4). The board is fused and the wires should be sized accordingly.
2. Connect solenoids between the selected output and the solenoid common. Solenoid common and (+) are internally connected through the fuse.

### ⚠ WARNING

#### Fuse Replacement

- ▲ Always replace the fuse with the proper type and rating.
- ▲ The fuse is Type 3 AG fast acting 3 Amp @ 250V.
- ▲ Do not use slow blow fuses.
- ▲ Failure to comply with the requirement will void manufacturer's warranty.

Power requirements: Check supplied panel and its manual for supply voltages.



**Fig. 5.4** Timer board power source

3. Ground the filter carefully.

## 5.7 Timer Board Adjustments

The timer board in the control panel governs the frequency OFF time and duration ON time of each pulse.

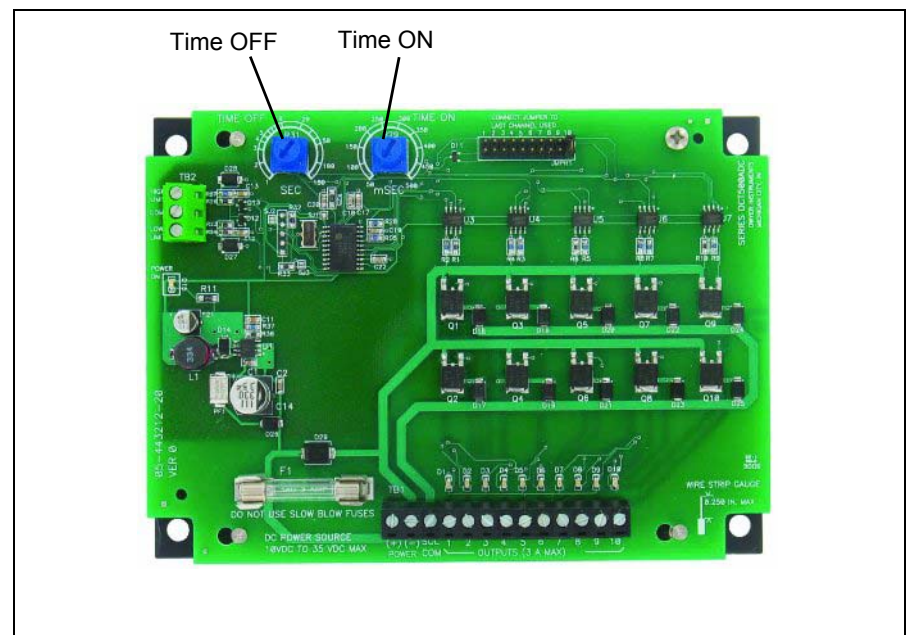
- The ON time is adjustable from 50 to 500 milliseconds. Begin with a setting of 50 milliseconds.
- The OFF time is adjustable from 1 to 180 seconds. Settings should be based on the material being filtered: 8-10 seconds for powders, 10-20 seconds for granular, 20-45 seconds for pellet size material.

1. Set the ON and OFF time dials, shown in [Fig. 5.5](#). Initial ON time should be set to around 200 milliseconds. Initial OFF time settings should be set to around 15 seconds.

⇒ The ON time setting should create a quick blast of air into the filter during each pulse. The OFF time should always allow the pressure at the air accumulator to recover to 5.5 - 6.9 bar [80 - 100 PSI] before each pulse.

**i**

- These timer settings will work well for most installations.
- If the material being filtered is particularly dusty, the differential pressure across the filters may rise to a higher-than-acceptable level after the system has been in full operation for several hours (e.g., if a reading of 12.5 mbar [5" WG] or more displays on the differential pressure gauge). If this happens, follow the instructions in Section 9.4, "Timer Board Readjustment".



**Fig. 5.5** Timer board "ON" and "OFF" time dials





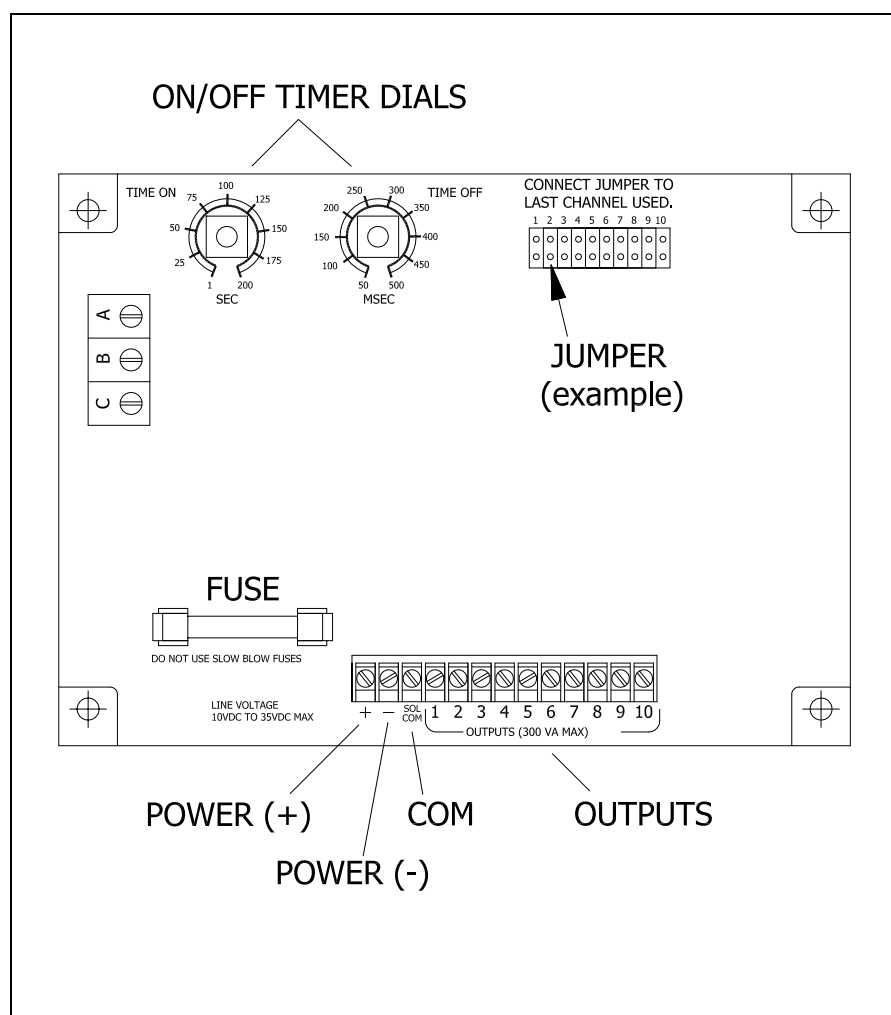
## ⚠ DANGER

### Mortal danger as a result of live wires

- ▲ De-energize the power supply to the timer board before completing the next step.

Place jumper near the right top corner of the board on the two pins corresponding to the last channel used in the installation.

Example, if there are two bin vents used, place the jumper on pins labeled 2.



**Fig. 5.6** Place jumper on pins labeled 2

## 5.8 Compressed Air Connections

### NOTICE

#### Damage of the system

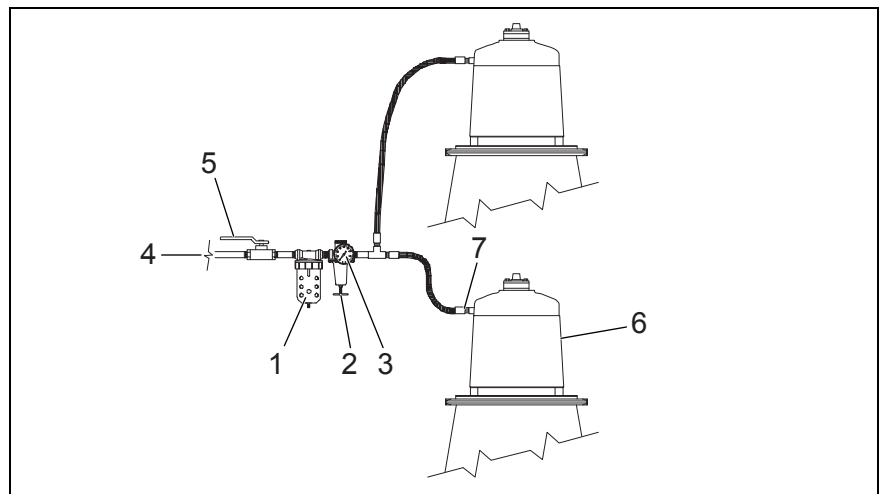
- ▲ Disconnect air supply when disassembling pneumatic equipment.
- ▲ De-energize the timer board.

**i**

- The compressed air must be clean, dry and oil-free.
- Maximum 6.9 bar [100 PSI] gauge from the main supply.
- For each Modular Cartridge Bin Vent a connection to the compressed air is needed.
- The pneumatic links of the valve must be rigidly connected before the electrical links are connected.
- One condensed water separator, regulator, and gauge assembly can be shared by all bin vents devices on a tank.

1. De-energize the timer board.
2. Connect a source of 5.5 to 6.9 bar [80 to 100 PSI] of clean, dry, compressed air to the air accumulator.
3. (Compressed air accessories are not supplied with the Modular Bin Vent Cartridge assembly.) A condensed water separator (1), regulator (2), and gauge assembly (3) is recommended to control the air pressure and to filter the air supply. These are available through the Coperion K-Tron Spare Parts department.

- (1) Condensed water separator
- (2) Regulator
- (3) Gauge
- (4) Compressed air source
- (5) Shut-off valve
- (6) Modular Cartridge Bin Vent
- (7) .64 cm [1/4]" NPT air connection



**Fig. 5.7** Air pressure maintenance unit (Pos. 1, 2, 3) (example)

**i**

- In certain areas where the climate is particularly moist, the filter may not be adequate to remove all moisture, and a dryer may be required.

4. Start the compressed air supply and pressurize the supply line.
5. Adjust the regulator until the gauge reads 5.5 - 6.9 bar [80 - 100 PSI] by turning the adjusting knob at the bottom of the regulator.
6. Secure the regulator knob.
7. Check for air leaks in the compressed air piping and connections on the device.
8. With the compressed air supply system operating, energize the timer board.
9. Ensure that each solenoid is functioning properly. Listen for a click with each pulse and feel for bursts of air from the exhaust ports. If air is venting out of the exhaust ports continuously or there is no clicking, refer to section 10, error "*Solenoid valve malfunction*" and error "*Diaphragm valve malfunction*".

## 6 START-UP



### **⚠ WARNING**

#### **Risk of injury and poisoning by the transport medium**

- ▲ Personal protective clothing is to be worn for all work on the device.
- ▲ The safety instructions for handling these materials must be adhered to.



### **⚠ CAUTION**

#### **No Hands Icon**

- ▲ The device may only be operated once it has been installed or fitted.

### **NOTICE**

#### **Risk of damage to property medium**

- ▲ Never use the equipment to process materials which may cause a chemical reaction with the materials of the equipment, for example feed materials containing the following substances:
  - Acid
  - Iodine
  - Chromium
  - Bromide

### **NOTICE**

#### **Risk of damage by foreign bodies**

- ▲ Before start-up ensure that the feeder are free of objects.



For more information see system operating instructions and functional design in the systems project manual.

## 6.1 Start-Up Checklist



### **⚠ DANGER**

#### **Danger of explosion**

- ▲ Static discharge caused by improper grounding may result in accidents or explosions! All transport equipment, transport and vacuum pipes must be grounded.

1. Check for proper installation of the device to the tank or hopper, ensuring a tight connection.
2. Check for proper installation of the cartridge filter (see section 5.3).
3. Check for proper electrical wiring to terminals +24VDC and 0VDC on the timer board (see section 5.4).
4. Check for proper installation of the condensed water separator, regulator, and gauge assembly (see section 5.8). Verify that the compressed air piping is not too small or restricted. Air pressure at the air accumulator needs to recover 5.5 - 6.9 bar gauge [80 - 100 PSI gauge] before each pulse. With the compressed air system operating, check for air leaks in the supply piping and on the device.
5. Ensure that the solenoids are all operating properly. Listen for a click with each pulse.
6. Verify that all diaphragm valves are operating properly. Listen for air pulses from each valve.
7. Verify that the OFF and ON timers on the timer board are set to achieve sufficient cartridge cleaning (see section 9.5).

## 7 OPERATION

### **WARNING**



#### **Risk of injury and poisoning by the transport medium!**

- ▲ Personal protective clothing is to be worn for all work on the device.
- ▲ The safety instructions for handling these materials must be adhered to.

### **CAUTION**



#### **No Hands Icon**

- ▲ The device may only be operated once it has been installed or fitted.

### **NOTICE**

#### **Risk of damage to property**

- ▲ Never use the equipment to process materials which may cause a chemical reaction with the materials of the equipment, for example feed materials containing the following substances:
  - Acid
  - Iodine
  - Chromium
  - Bromide

### 7.1 Switching On/Off

⇒ Switch the equipment on/off with the provided controls

For more information, see systems manual.



## 8 CLEANING



### **WARNING**

#### **Risk of injury posed by unintentional switching on**

- ▲ Switch off the equipment before every intervention and secure it against unintentional restarting (see section 8.1).
- ▲ Depressurize the system. Manually activate the solenoid valves for this purpose.



### **CAUTION**

#### **Risk posed by dust ejection**

- ▲ Dust ejection may result in breathing problems.
- ▲ Wear a respiratory protection.

### **NOTICE**

#### **Damage to property caused by corrosive and toxic detergents**

- ▲ Follow the safety regulations for dealing with cleaning agents. After use dispose properly the cleaning agents.
- ▲ Use only cleaning agents with  $5.0 < \text{pH} < 8.5$ .
- ▲ Clean with non-toxic cleaning agents and disinfectants.
- ▲ Only use cleaning agents that not affect the used seal and filter materials (silicone / PTFE / Teflon / polyester fabric not included).
- ▲ Any residues of cleaning agent on parts with product contact are not allowed.
- ▲ Do not clean with high pressure cleaners, steam cleaner or compressed air.
- ▲ Not remove product adhesion with force.
- ▲ There must no moisture on electrical components.
- ▲ All parts must be dry cleaned before assembly.

## 8.1 Switching Off the Installation



1. Switch off the equipment at the main switch.
2. Secure the main switch with a lock.
3. Attach a danger sign to the main switch.
4. Switch off the air and vacuum supply and lock the switch.
5. Depressurize the compressed air tank by manually operating the discharge valve.

## 8.2 Notes on Cleaning



- Empty the device before cleaning.
- Clean only with mild air stream.
- In case of external soiling, clean with a damp cloth and use normal industrial cleaners
- Use vacuum cleaner or soft brush for cleaning.
- Remove dust layers over 5 mm.



## 9 MAINTENANCE



- Maintenance work may only be carried out by trained technicians.
- Only qualified electricians may work on the electrical equipment.

### 9.1 Maintenance Intervals

Element	Checkpoints	Interval
Mechanics	<ul style="list-style-type: none"> <li>• Eliminate dust accumulation more than 5 mm [0.2 in] through cleaning.</li> <li>• Check convey and vacuum line mechanical connections for tightness.</li> <li>• Check seal rings for damage</li> <li>• Check safety symbols at the equipment for legibility and completeness.</li> </ul>	⇒ Check pressure regulator
Pneumatics	<ul style="list-style-type: none"> <li>• Check the compressed air settings.</li> <li>• Empty condensed water separator.</li> <li>• Change filters</li> <li>• Weekly</li> </ul>	⇒ Daily ⇒ Monthly ⇒ Every 6 months ⇒ As required
Electric	<ul style="list-style-type: none"> <li>• Visually check all electrical cables and connections.</li> <li>• Electrical inspection with test protocol by an electrician (insulation inspection, voltage inspection, protective conductor, protection against residual voltages)</li> </ul>	⇒ Daily  ⇒ Every 4 years

## 9.2 Safety Instructions for Maintenance

### WARNING



#### Risk of injury posed by unintentional switching on

- ▲ Switch off the equipment before every intervention and secure it against unintentional restarting (see section 9.3).
- ▲ Depressurize the system. Manually activate the solenoid valves for this purpose.

### CAUTION



#### Risk posed by compressed air

- ▲ Depressurize the system.  
Depressurize the compressed air tank by manually operating the discharge valve.
- ▲ Before opening the quick access door to access the filter media, detach the air line from the air accumulator/sequencing valve.

### CAUTION



#### Risk posed by dust ejection

- ▲ Dust ejection may result in breathing problems.
- ▲ Wear a respiratory protection when opening the quick access door.

## 9.3 Switching Off the Installation



1. Switch off the equipment at the main switch.
2. Secure the main switch with a lock.
3. Attach a danger sign to the main switch.
4. Switch off the air and vacuum supply and lock the switch.
5. Depressurize the compressed air tank by manually operating the discharge valve.

## 9.4 Timer Board Readjustment

1. After the device has been in service for several hours, the timer board settings may need to be readjusted to compensate for greater-than-average dust loading.
2. Adjust the OFF time setting in the timer control panel to a shorter interval.
3. Observe the pressure gauge on the compressed air supply during operation. If the OFF time is set too short, the pressure in the air accumulator will be unable to recover between pulses.
4. Adjust the ON time on the timer board to a longer interval if the pulse is not adequate. However, do not increase the ON time more than necessary to achieve the desired results, as this will deplete the compressed air supply.

## 9.5 Cartridge Filter Life

**i**

- If the pressure differential occurs too quickly, additional bin vents may be required for your application, or the air pulsing may not be adequate.



**Fig. 9.1** Cartridge filter

1. Moisture in the Modular Cartridge Bin Vent cartridge filter will shorten its life. See section 10, *error "Dirty or moist compressed air"*.
2. Over time, the cartridge filter element can be damaged if the air pressure exceeds 6.9 bar [100 PSIG], or if pulsing is too frequent.
3. When the cartridge filter element becomes blinded, its pressure differential becomes too great. This differential in pressure can be measured by attaching a differential pressure gauge to the connection on the housing.
4. If this pressure differential occurs, the filter element will need to be cleaned or replaced.
5. Ensure proper air pulsing, timer settings, compressed air supply, and valve operation as described in other parts of this manual.

## 9.6 Inspecting and Cleaning the Cartridge Filter



### ▲ CAUTION

#### Risk posed by compressed air

- ▲ Turn off the compressed air supply and pulse the cartridge filter to empty compressed air from the accumulator before proceeding.



Fig. 9.2 Cartridge filter

1. Allow the timer control panel to pulse-clean the cartridge filter for a time without any dust or air loading.
2. Shut off the compressed air supply and disconnect it from the unit only after the accumulator is no longer pressurized.
3. Unhook the V-clamp and carefully remove the top plenum section. Lift the cartridge filter from the housing.
4. If the cartridge filter appears damp or encrusted, before cleaning or replacement see section 10, *error "Damp or encrusted cartridge filter"*.
5. Using compressed air (6.9 bar [100 PSI] maximum), clean the cartridge filter to remove as much dust as possible. Keep the air nozzle at least 15 cm [6 inch] away from the filter, and always spray from the inside out (same as the pulsing occurs during operation).
6. Inspect the cartridge filter for damage. If damaged, continue with step 10 below. If the cartridge is now clean, continue with step 11. If a more thorough cleaning is required, continue with step 7.
7. Allow the cartridge filter to soak for 5 minutes in a solution of mild dish washing detergent, mixed at 2% soap to 98% warm water. For extra cleaning, gently agitate the water by running a compressed air hose into the container while holding the cartridge filter.

### NOTICE

#### Risk of damage by high pressure

- ▲ Do not use water at high pressure when rinsing the cartridge filter.
8. Rinse the cartridge filter thoroughly using a water hose from the inside to the outside.
  9. Allow the cartridge filter to dry completely. This will take at least 48 hours at 21°C [70°F]. Protect the cartridge filter from dust during the drying process.
  10. If the cartridge filter is unusable after cleaning, it must be replaced. Replacement cartridge filters are available from Coperion K-Tron Spare Parts Department.

11. Ensure that the gasket (located on the underside of the cartridge filter's flange) is in good condition. Reassemble the bin vent by lowering the cartridge filter element into the housing, placing the top (plenum) section on top of the housing, and securing the V-clamp. Ensure a tight seal by using a gasket between the housing and cartridge filter.
12. Connect compressed air to the accumulator.

## 10 TROUBLESHOOTING



- ⇒ Please observe the error messages which are displayed on the connected control device or host computer (see operating instructions for the relevant control device).
- ⇒ Document faults and call the local service center (customer service see project manual).

### **WARNING**



#### **Risk of injury posed by unintentional switching on**

- ▲ Switch off the device before every intervention and secure it against unintentional restarting.
- ▲ Depressurize the system. Manually activate the solenoid valves for this purpose.



1. Switch off the equipment at the main switch.
2. Secure the main switch with a lock.
3. Attach a danger sign to the main switch.
4. Switch off the air and vacuum supply and lock the switch.
5. Depressurize the compressed air tank by manually operating the discharge valve.

## 10.1 Troubleshooting Table

Error	Troubleshooting
<b>Damp or encrusted cartridge filter</b>	<ol style="list-style-type: none"> <li>1. Check for moisture in the compressed air source. The air must be dry. See <i>error "Dirty or moist compressed air"</i>.</li> <li>2. The solenoid valve, which controls the pulsing of the cartridge filter, may not be operating properly. See <i>error "Solenoid valve malfunction"</i>.</li> <li>3. Check to see if the cartridge filter is dirty. If necessary, clean the cartridge filter. See section 9.6, <i>"Inspecting and Cleaning the Cartridge Filter"</i>.</li> </ol>
<b>Dirty exhaust air</b>	<ol style="list-style-type: none"> <li>1. To reach the best operating efficiency of the cartridge filter, allow the device to operate 48 to 96 hours while material is being pneumatically conveyed. This is a sufficient amount of time to allow the filter cake on the outside of the cartridge filter to accumulate, enabling maximum particle filtration efficiency.</li> <li>2. Check for proper filter cartridge installation (see section 5.3.). The clamp may need to be retightened.</li> <li>3. Check the cartridge filter for wear or holes, replacing it if needed.</li> <li>4. If the gauge on the condensed water separator, regulator, and gauge assembly reads over 6.9 bar [100 PSI] the cartridge filter may be stressed excessively, allowing fine dust to pass through the cartridge. Adjust the condensed water separator, regulator, and gauge assembly to a gauge reading of 5.5 - 6.9 bar [80 – 100 PSI].</li> <li>5. If the cartridge filter appears damaged, see section 9.6.</li> <li>6. Ensure that the compressed air is clean and dry.</li> </ol>
<b>Sluggish pulses</b>	<ol style="list-style-type: none"> <li>1. Check for the correct setting of 5.5 - 6.9 bar [80 – 100 PSI] at the condensed water separator, regulator, and gauge assembly. The air pressure should recover quickly after each pulse. If it doesn't, an undersized or restricted supply line could be the cause.</li> <li>2. The diaphragm valves may not be operating properly. See <i>error "Diaphragm valve malfunction"</i>.</li> </ol>
Table page 1 of 3	

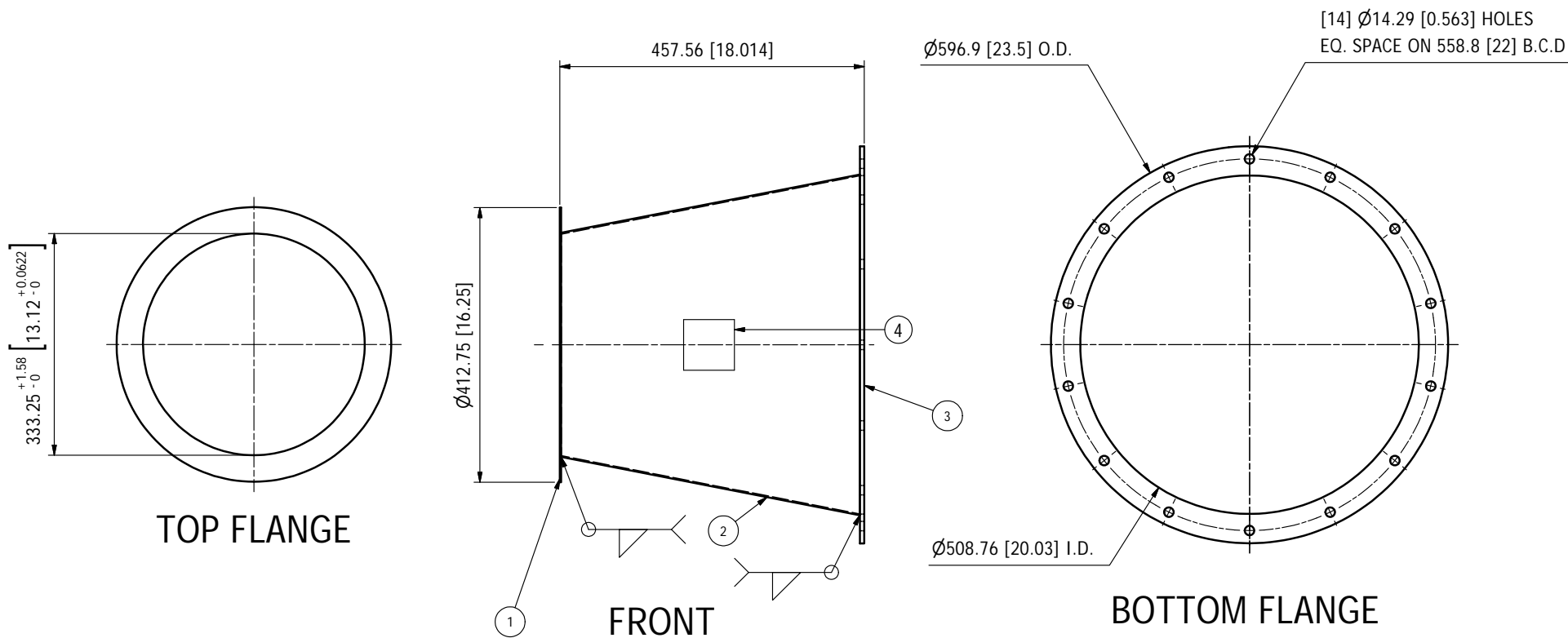


Error	Troubleshooting
<b>Dirty or moist compressed air</b>	<ol style="list-style-type: none"> <li>1. Inspect the filter element in the condensed water separator, regulator, and gauge assembly, cleaning if necessary. If the polycarbonate bowl is dirty, wipe it with a dry, clean cloth.</li> <li>2. The condensed water separator, regulator, and gauge assembly is not capable of removing large amounts of moisture. If the climate is moist, a dryer may need to be installed in the compressed air supply system, along with the condensed water separator, regulator, and gauge assembly.</li> <li>3. The air accumulator may need cleaning. De-energize the timer board, and disconnect the compressed air supply. Place the accumulator on its side, allowing the moisture to drain out of the compressed air connection. Reassemble the unit.</li> </ol>
<b>Diaphragm valve malfunction</b>	<ol style="list-style-type: none"> <li>1. If a diaphragm valve stays open, compressed air will flow continuously through the cartridge filter. The solenoid valve may be stuck open. Disassemble the valve and check the solenoid piston and spring, or replace the valve. A new diaphragm valve is available as a spare part from Coperion K-Tron Spare Parts Department.</li> <li>2. If the diaphragm valve stays closed, compressed air will not pulse the filter. The diaphragm may be broken or the solenoid may have failed. Replace the valve or solenoid, if necessary.</li> <li>3. Check for cut wires connected to the valve.</li> <li>4. See <i>error "Diaphragm valve malfunction"</i> and <i>error "Time board malfunction"</i>.</li> </ol>
<b>Solenoid valve malfunction</b> No click can be heard with each pulse.  (If the solenoid valve is operating properly, a click can be heard with each pulse.)	<ol style="list-style-type: none"> <li>1. Check for dirt in the solenoid valve. Clean with compressed air.</li> <li>2. If a continuous flow of air is felt from the exhaust port, the diaphragm valve is not seated properly. Remove the four bolts that hold the top of the diaphragm valve on, and clean out any dirt, scale, or rust. Inspect the spring and solenoid piston for broken parts. If the piston or spring are damaged or worn, they will need to be replaced. A replacement solenoid valve is available as a spare part from Coperion K-Tron Spare Parts Department.</li> <li>3. If there is no click coming from the solenoid valve, check for the correct supply voltage across the coil during its designated pulse cycle.               <ul style="list-style-type: none"> <li>– If there is no voltage, see <i>error "Time board malfunction"</i>.</li> <li>– If the full voltage is detected, the coil may be burned out. A replacement coil is available as a spare part from Coperion K-Tron Spare Parts Department.</li> <li>– If the full voltage is detected, verify that the ON time is set at a long enough interval for the solenoid to become fully energized.</li> </ul> </li> </ol>


Error	Troubleshooting
<b>Time board malfunction</b>	<ol style="list-style-type: none"> <li>1. Verify that electrical power is connected to the board. See section <a href="#">5.5</a>.</li> <li>2. Check for electrical continuity in the wires leading to each solenoid from the timer board.</li> <li>3. Verify that the program jumper on the timer board is positioned for the number of solenoids (one solenoid per bin vent) being serviced.</li> <li>4. Check the fuses, ensuring that they are not blown.</li> </ol>

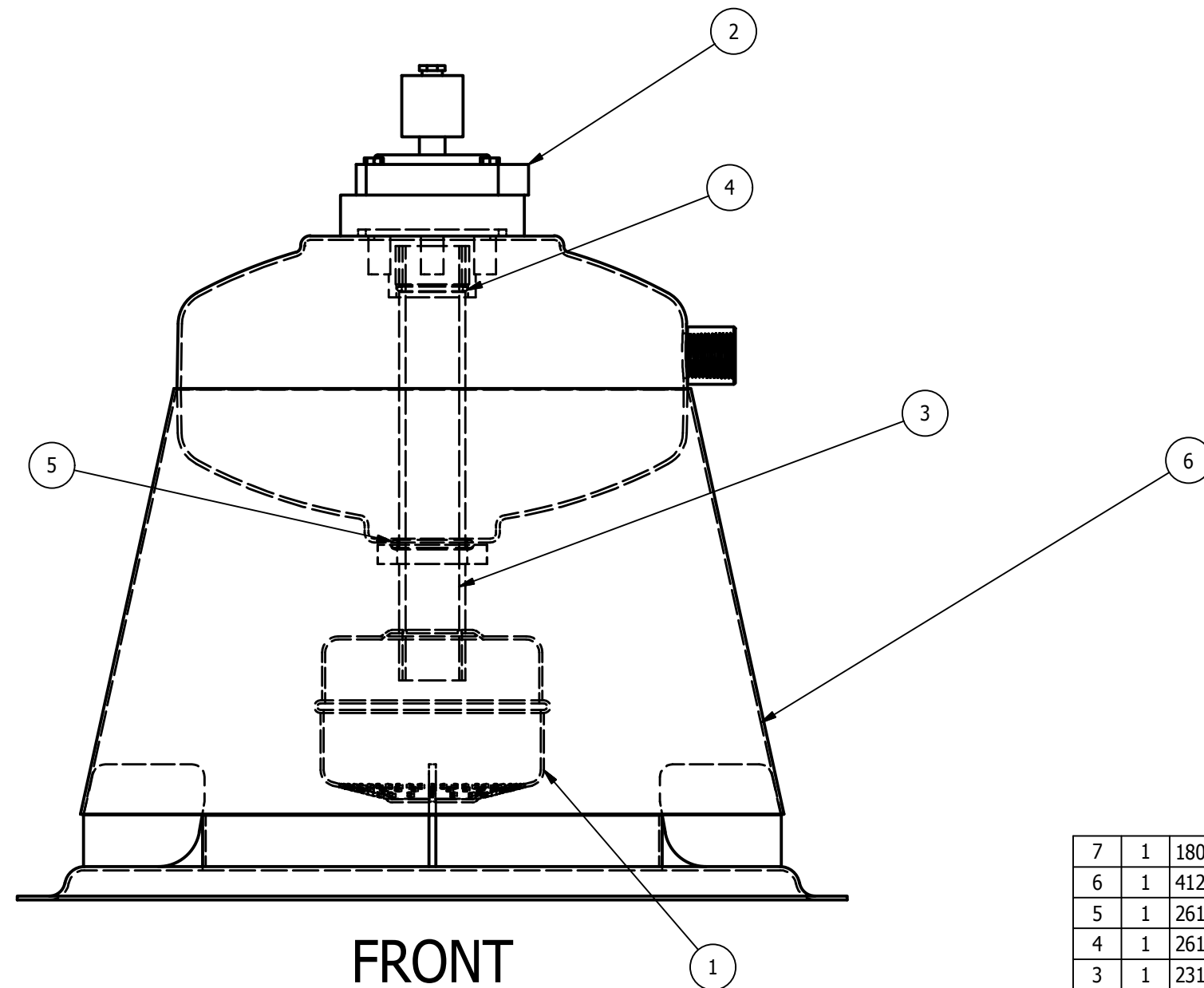
Table page 3 of 3







NOTES:  
1. DEBURR ALL SHARP EDGES.

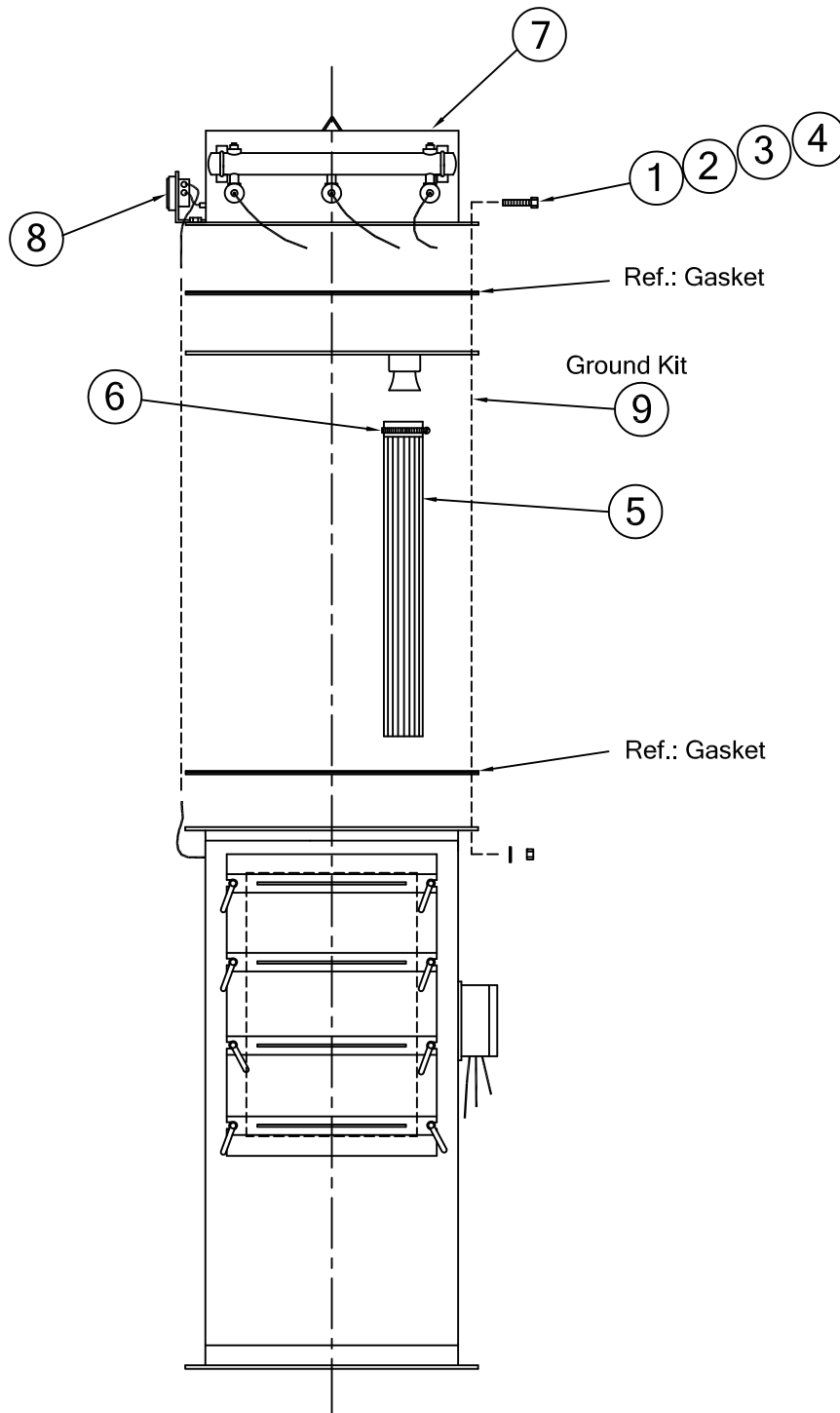
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FILTER MOUNTING CONE S.S.		THIRD ANGLE	APPROVED	MM.DD.YYYY SIGN	
				4/6/2011 PPI	
PAGE 1 OF 1		CATEGORY P-Level			
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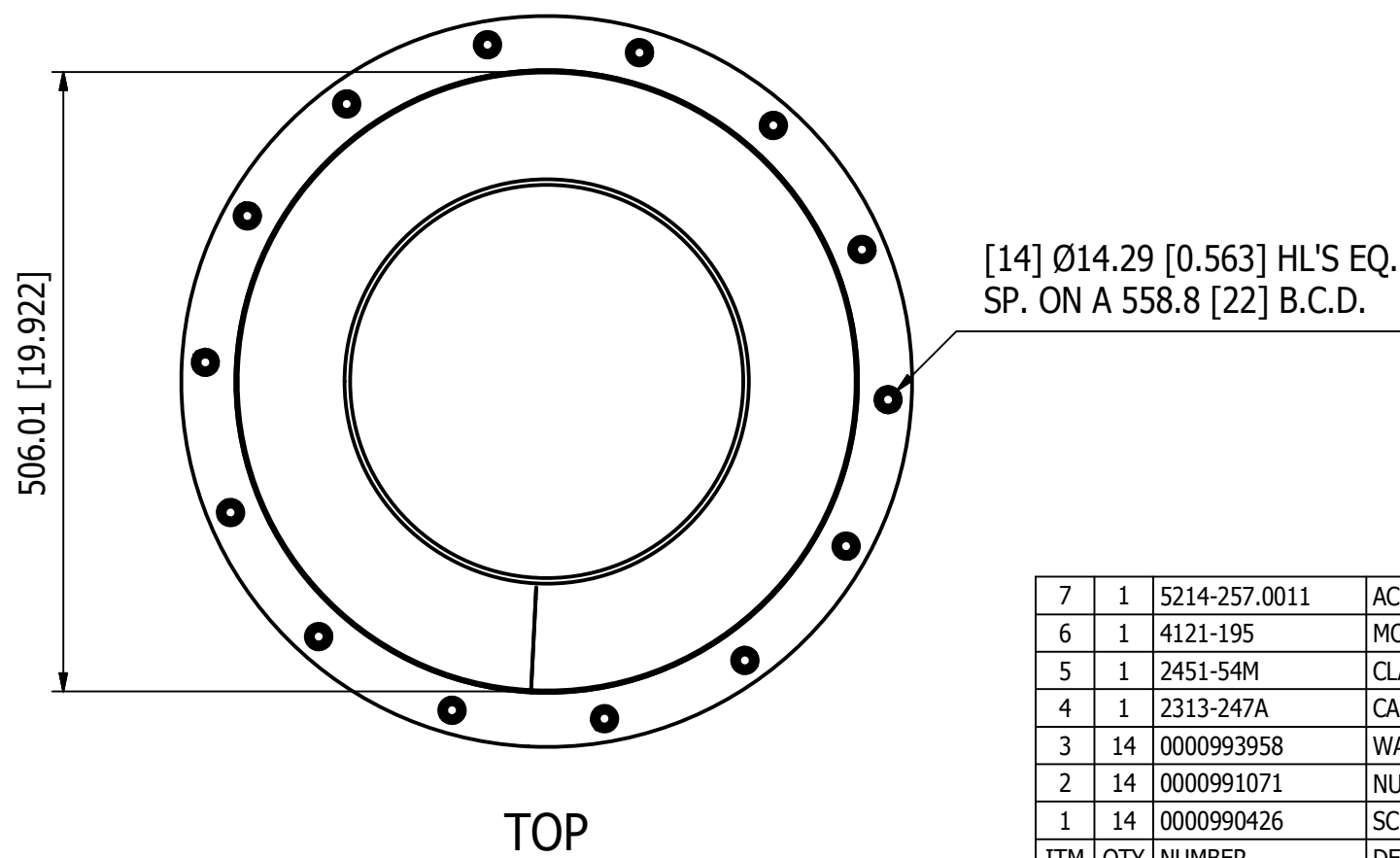
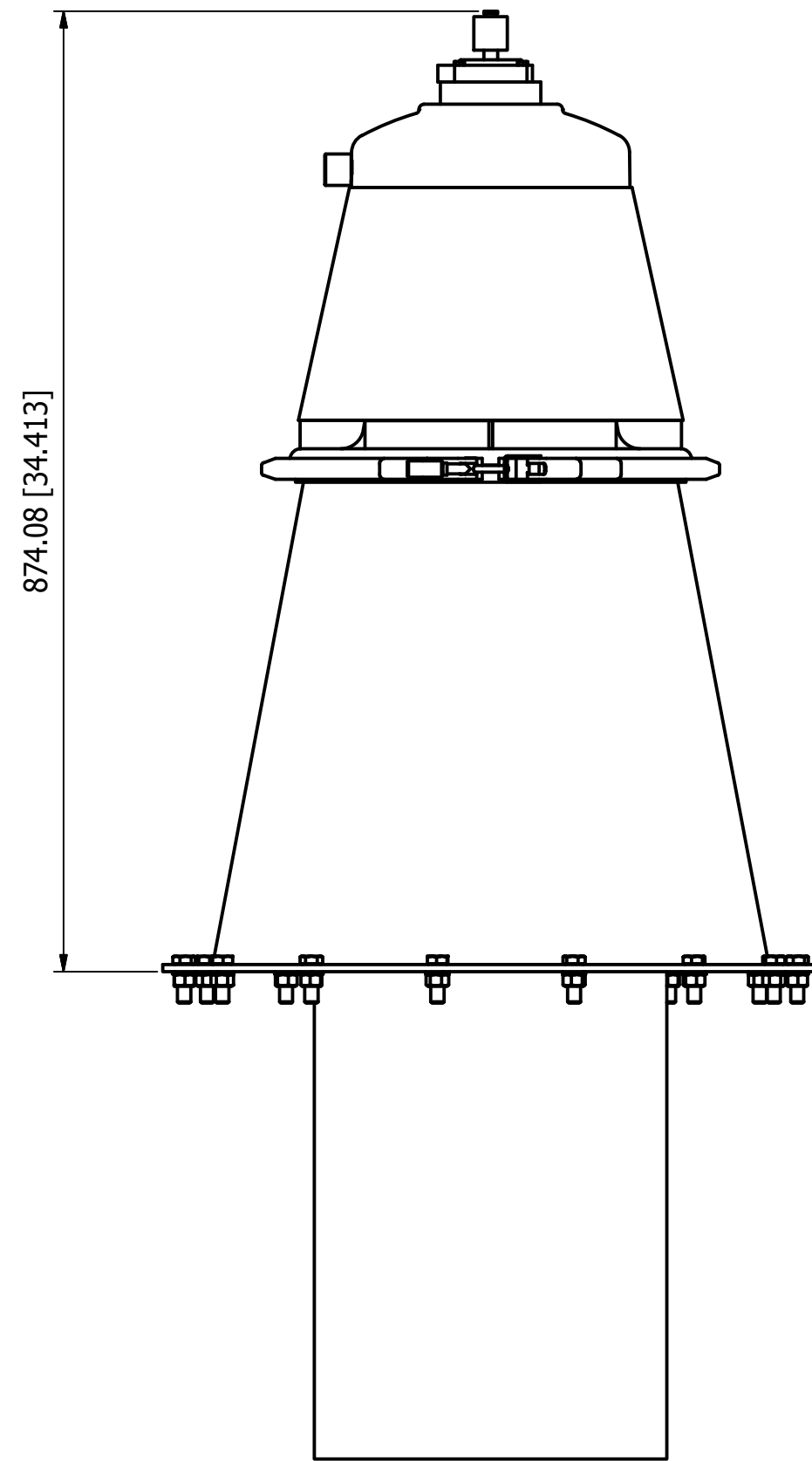
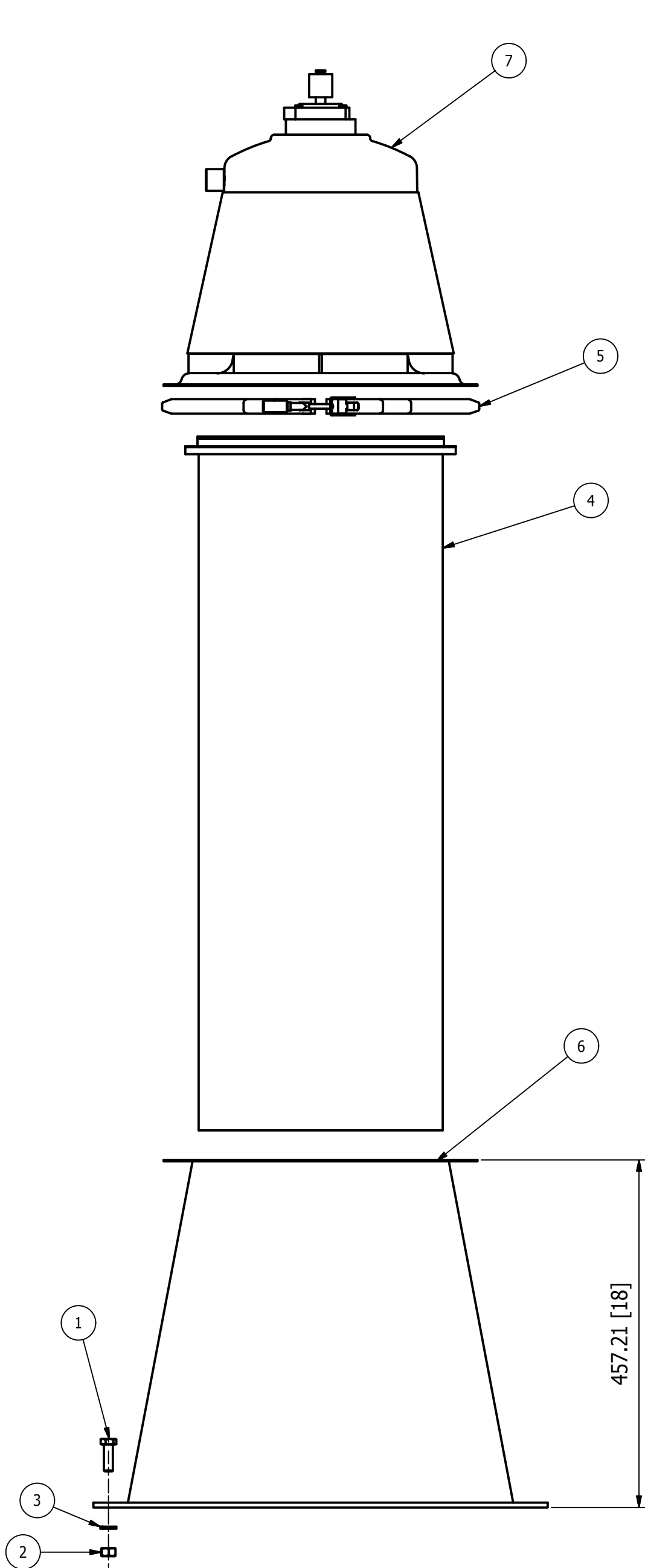
7	1	1802-111	ASSEMBLY & STICKER APPLICATION	
6	1	4121-180.0005	HEADER ASSEMBLY SS	
5	1	2614-42	O-RING 1.25 ID 1.625 OD	NR
4	1	2614-41	O-RING 1.1875 ID 1.375 OD	NR
3	1	2315-885	1" X 6" PULSE PIPE	S235JR   ASTM A36
2	1	2315-883	VALVE, DIAPHRAGM 1" IMMERSION W/ COIL ATEX 3GD	EN AW-5052   AA-5052
1	1	2314-61	SILENCER, HEADER	Default
SEQ	QTY	NUMBER	DESCRIPTION / SUPPLIER	MATERIAL
VENT				SCALE 1 : 3
ACCUMULATOR ASSEMBLY MODULAR				DRAWN DD.MM.YYYY SIGN 2/15/2016 JWP
CARTRIDGE BIN VENT FILTER SS				THIRD ANGLE  APPROVED DD.MM.YYYY SIGN 2/15/2016 JP
				PAGE 1 OF 1 CATEGORY P-Level-X
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			NUMBER 5214-257.0011	REV A

## BIN VENT FILTER PARTS

### Cartridge Filters



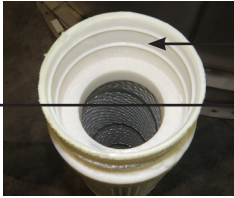
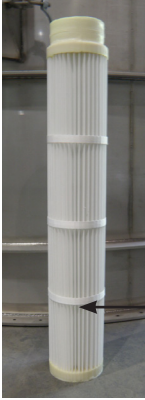
Line No.	System-Item	Part No. & S-No.	Description	Quantity
200	01-001	F25214-257.0011	FIL,MODULAR CRTG BIN VENT SS	
200	01-001	0000990426	SCREW,304 SS HHD M12X1.75X35	42
200	01-001	0000991071	NUT, HEX 304 SS M12X1.75	42
200	01-001	0000993958	WASHER, LOCK 304 SS M12 MED	42
200	01-001	1708-5	ADHSV,SEALANT 3/16"BEAD	3
200	01-001	2313-247	CTDG,12-3/4"X36"LG SS FDA SB	3
200	01-001	2451-54M	CLAMP,15" V-BAND	3
200	01-001	4121-195	MTG CONE,SS MDL CRTG BIN VT	3
200	01-001	5214-257.0011	MODULAR CARTRIDGE BIN VENT FLT	3



7	1	5214-257.0011	ACCUMULATOR ASSEMBLY MODULAR	
6	1	4121-195	MODULAR CARTRIDGE BIN VENT	
5	1	2451-54M	CLAMP, 15" V BAND	X2 CrNiMo17-12-2
4	1	2313-247A	CARTRIDGE FILTER 12-3/4"X36"Lg SS	DC04 ; ASTM A1008 DDS
3	14	0000993958	WASHER / SCHEIBE - LOCK HLCL M12 12.7/21.1x2.5 DIN	A2 ; AISI 304
2	14	0000991071	NUT / MUTTER - HEX M12 ISO4032	A2 ; AISI 304
1	14	0000990426	SCREW / SCHRAUBE - HEX M12x35 ISO4017	A2 ; AISI 304
ITM	QTY	NUMBER	DESCRIPTION	MATERIAL
VENT				SCALE 1:6
MODULAR CARTRIDGE				DRAWN 2/15/2016 JWP
BIN VENT FILTER ASSEMBLY, 304SS				THIRD ANGLE APPROVED DD.MM.YYYY SIGN 2/15/2016 JP
				PAGE 1 OF 1 CATEGORY P-Level-X
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## K-Tron Cartridge Filter Installation



1. Slip the metal clamp over the top rim of the cartridge filter before starting installation.

Annular Ring

Cartridge Filter



Tube Sheet

Cartridge Cup

Metal Clamp



2. Slip the top part of the cartridge rim over the metal cartridge cup hanging from the tube sheet. Push the top of the cartridge rim against the bottom of the tube sheet until the annular ring snaps into the corresponding groove on the cartridge rim.



3. Tighten the clamp around the cartridge filter rim at a point above the annular ring on the cartridge filter rim until the cartridge filter cannot be rotated around the cartridge cup by hand. Periodic retightening of the clamps is recommended.
4. Repeat steps 1 through 3 for each cartridge filter. Once all cartridges are in place, ensure that the filters are hanging straight and not touching each other or the filter receiver housing.

PART NO. F25214-257.0011

S-NO.

DESCRIPTION: FIL,MODULAR CRTG BIN VENT SS

Item No.	Part No.	Description	See Notes	Quantity Per Unit
1	0000990426	SCREW,304 SS HHD M12X1.75X35		14.0
1	2314-61	SILENCER, HEADER	RSP	1.0
2	0000991071	NUT, HEX 304 SS M12X1.75		14.0
2	2315-883	VALVE,DIAPH 1"SLND 24V EX 3GD	RSP	1.0
3	0000993958	WASHER, LOCK 304 SS M12 MED		14.0
3	2315-885	PIPE, 1" X 6" PULSE PIPE		1.0
4	2313-247	CTDG,12-3/4"X36"LG SS FDA SB	RSP	1.0
4	2614-41	O-RING, 1-3/16"ID X 1-3/8" OD	RSP	1.0
5	2451-54M	CLAMP,15" V-BAND		1.0
5	2614-42	O-RING, 1-1/4"ID X 1-5/8" OD	RSP	1.0
6	4121-195	MTG CONE,SS MDL CRTG BIN VT		1.0
6	4121-180.0005	HEADER,MODULAR CARTRIDGE BINVT		1.0
7	5214-257.0011	MODULAR CARTRIDGE BIN VENT FLT		1.0
7	1802-111	PROCEDURE, MODULAR BIN VENTS		.0

Notes: RSP Item is a recommended spare part.

SUB Item is a subassembly. Parts information is on a following page or in a separate section of this manuals as specified in the manual index.