The Great Lakes Construction Co.

TRANSMITTAL
No. 163

10737 Medallion Drive
Cincinnati, Ohio 45241

PROJECT: ODOT 150085 HAM 71-1.34

DATE: June 15, 2017

TO: ODOT District 8
505 South SR 741
Lebanon, OH 45036

REF: TVS Fan Isolation Dampers User Manual R-01

ATTN: Marvin Lennon

WE ARE SENDING		SUBMITTED FOR:		ACTION TAKEN:	
	Shop Drawings		Approval		Approved as Submitted
	Letter		Your Use		Approved as Needed
	Prints		As Requested		Returned after Loan
	Change Order	X	Review and Comment		Resubmit
	Plans			X	Submit
	Samples	**SENT VIA:**			Returned
	Specifications	X	Attached		Returned for Correction
X	Other: Submittals per Plan Notes		Separate Cover:		Due Date: 6/22/2017

SUBMITTAL	COPIES	DATE	DESCRIPTION
TVS Fan Isolation Dampers User	1pdf	6/15/2017	TVS Fan Isolation Dampers User Manual R-01

REMARKS: This TVS Fan Isolation Dampers User Manual R-01 submittal provides information per plansheet 359/555.

Plan Notes do not include a review/approval timeframe. We are requesting to have the review of submittal completed by 6/22/17.

Signed:

Ryan W. Jones, P.E.

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

I-71 Lytle Tunnel Under Lytle Park Bridge No.: HAM-71-0314

Damper IOM Package

GFC Document No.: T243-201, R0

Prepared By

Bill Lampkin
Product Manager, Industrial Damper Group

Revision No.	Date	Description
0	4/10/17	Original Submittal

2012 WISCONSIN MANUFACTURER OF THE YEAR

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

TABLE OF CONTENTS

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

Section Ⅰ

Damper Supplier Information

2012 WISCONSIN MANUFACTURER OF THE YEAR

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

I. Damper Supplier Information

Damper Manufacturer

Greenheck Fan Corporation
PO Box 410
Schofield, Wisconsin, USA 54476

Phone: 715-359-6171
Fax: 715-355-3189

Project Number: T166

Damper Service Center

Greenheck Fan Corporation
PO Box 410
Schofield, Wisconsin, USA 54476

Phone: 715-359-6171
Fax: 715-355-3189

Greenheck Territory Sales Representative

EAP Inc,
3930 Virginia Ave
Cincinnati, Ohio 45227
Office 513-332-2090

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

Section Ⅱ

System Information

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

II. System Information

A. Operational Limits

Dampers

Maximum Differential Pressure	12 in-wg
Maximum Design Velocity	2000 FPM
Maximum Leakage Rate	14 cfm/sq ft @ 12 in-wg
Normal Operating Temperature	Ambient
Maximum Temperature	482° F for 1 hour,

Damper Operators

Operating Power Supply	AC115V/1PH/60Hz
Normal Operating Temperature	Ambient
Maximum Temperature	482° F for 1 hour

Damper Limit Switches

Operating Power Supply	5 amp @ 125/250/480 vac
Normal Operating Temperature	Ambient
Maximum Temperature	482° F for 1 hour

B. Description of Damper Component Parts

Model: Damper to be Greenheck model HTD-630.

Frame:	12" x 3" x 1-1/2" channel, 3/16" thk, HRPO
	seal-welded frame corners
	Tie rods (for dampers > 60" H), CRS round bar
	Ø1/2" for dampers ≤ 48" W, Ø3/4" for dampers > 48" W
	Damper frame assembly finish is hot-dip galvanized
Mounting holes:	As shown. Reference drawing T243-002 for values
Blades:	Double-skin formed airfoil, 14 ga, galvanized
	11-1/2" max width, blade action is parallel
	bolted to axles with zinc-plated fasteners
Axles:	Stub type, Ø3/4", 303 SS
Bearings:	Stainless steel sleeve type, pressed into SS housing, exterior removable
Linkage:	Clevis arms, 10 ga stainless steel

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

	Tie bar, 1/4" x 1-1/4" stainless steel, w/oil impregnated
	bronze bearings
	Clevis pin, stainless steel
	Cotter pin, stainless steel
Blade seal:	Silicone
Jamb seal:	Compression type, 316 SS
Finish:	Mill, unless otherwise noted
Structural support:	Structural carbon steel I-beam assembly
	Finish is hot-dip galvanized
Actuator:	RCS SURE with thermal blanket, 482°F for 1 hour
	115VAC, 1 phase, 50/60Hz, NEMA 4, two position, spring return, fail-closed
	4-SPDT switches, PTC heater, motor brake, manual override
	SURE-49: 15 sec/90° power operation, 2 sec/90° spring operation
	SURE-100: 10 sec/90° power operation, 5 sec/90° spring operation
	Actuator sized for 150% of max. design torque at 2,000 fpm
	and 14" w.g. damper operation
	Reference drawing schedule T243-002 for actuator
	sizing/quantity per damper
Limit switch:	Proximity 44TL0
	(4) SPDT switch elements,
	capable of operation at 482° F (250° C) for one hour
	Reference drawing schedule T243-002 for quantities
Electrical:	Actuators and limit switches factory wired to junction boxes
	using the following components:
	Hoffman Compact, cast aluminum, type 4X enclosure
	Marathon Special Products 2XX Series SP terminal block
	Liquatite Type - ATX flexible metal conduit
	Thermal Wire and Cable Corp. 250-14SRML wire
	Thomas & Betts Series 52 conduit fittings
Gasket:	Silicone, 50 Durometer Shore "A", 1/4" thk
	provided in rolls with pre-punched holes on 12" centers
	for use between 3" mounting flange and mating surface

.

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

Section Ⅲ

Installation Procedure

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

III. Installation Procedures

Read instructions through to the end before proceeding with installation. All of the damper assemblies furnished for the tunnel ventilation system for the Lytle Tunnel Project will be supplied with:

Damper sections are manufactured and installed as separate individual sections. RCS SURE49 or SURE100 (see damper drawings for specific model per tag) electric sprint return actuators. Actuators will be wired to a localized junction box mounted on the damper.

Each individual damper panel will be equipped with a Proximity Controls 44TL0 limit switch for monitoring the damper open and close position.

Installation:

The majority of operation and leakage problems are the direct result of damper installation out of square, racked (out of flat) or out of straight. All dampers are squared during manufacturing. However, dampers can easily be distorted by bolting to ductwork or steelwork that is not square and flat, improper handling, or by seal welding to mating ductwork. Inspect for straightness, squareness and flatness prior to lifting dampers onto the mounting surface and after flange fasteners are installed but not yet tightened to torque. The mounting surfaces for the dampers must be level, square and true to receive the damper panels. If surface irregularities are present, high temperature silicone caulk can be used to help seal the damper mounting surface after installation. However, in no case may the opening have irregularities to such a degree that binding of the damper blades may occur during operation. Inspect dampers for squareness when installation is complete and prior to cycling.

It is recommended that a silicone gasket be installed between the damper frame and the opening. This gasket will help protect the damper from premature rusting due to moisture and will also create an airtight connection between the damper and the opening. Gaskets are being supplied by GREENHECK.

The damper sections (panels) will have to be lifted up to the damper mounting surface, preferably using sturdy chains and a crane (or hoist), good lifting practices dictate the use of a spreader bar in this application. Bolt dampers to mounting surface using 3/8” diameter fasteners.

This process will have to be repeated for each section of dampers provided by GREENHECK.

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

Note:

The above is GREENHECK's recommended method for installing the dampers to their openings. Job site conditions, equipment available or contractors experience may allow better methods of installation to be followed. Therefore, these instructions are meant to be used as a guideline for the installation. Regardless of the method of installation, the damper must be mounted to a true and plum surface and must be free of any bending or twisting after installation. After final installation of dampers and prior to start-up, inspect the adjacent ductwork and surrounding area for any obstructions that will not allow freedom of movement of the damper on the interior or exterior of the duct.

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

Installation Checklist Form

To be complete during the installation of the damper

Task	*Task Completed*
Inspect the opening for squareness – use tape measures and other appropriate tools for this task	
Visually Inspect mechanical connections for dampers and actuators – It is possible for fasteners to loosen during transit to the job site.	
Ensure that all blades would be free to rotate upon power of the damper operators. If there are any obstructions, please remove them prior to operating the actuators.	
Perform operational checkout (including cycle testing) and verify position status with the main control panel	
NOTE: Fully Cycle the damper with the operator handwheel prior to using electrical power	
Cycle the damper with its operator a minimum of (5) times – operate both open and closed under power as recommended by the manufacturer	
Record the timing of the open power stroke – The time it takes for the damper to go from fully closed to fully open under electrical power of the actuator. Ensure that time is within a period of not more than 10 seconds	
Record the timing of the closed power stroke – The time it takes for the damper to go from fully open to fully close under electrical power of the actuator. Ensure that time is within a period of not more than 10 seconds	
Remove power to ensure that the damper actuator fails in place.	
Visually inspect damper blade closure for tight seal – In general "daylight" should be minimal between adjacent damper blades	

Damper Tag No.: _____

Authorization Signatures:

Name: _____
Firm: _____ Date: _____

Name: _____
Firm: _____ Date: _____

Name: _____
Firm: _____ Date: _____

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

Section Ⅳ

Operational Information

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

IV. Operational Information

A. Damper Pre-Operational Inspection List:

In general, the dampers must be kept clean and free from foreign matter that may impede normal movement and/or seating of the blades and seals. Therefore, dampers should be cleaned and inspected for general physical and mechanical condition. This inspection should include checking the mechanical tightness of bolted connections, visual inspection for the buildup of dirt or debris that may prevent damper closure and a general inspection for any obvious maintenance.

Inspect all connections holding the damper to the opening.

Inspect all fasteners holding actuator assemblies, splice plates, mullion covers, and limit switch mounting angles.

Damper blades, jamb seals, linkage pivots, etc. should be wiped clean to insure that dirt build up will not impede the operation of the damper.

Jamb seals should also be inspected for damage and to insure that they are sealing properly.

Once the dampers have been cleaned and thoroughly inspected, they should be cycled open and closed several times with their actuator assemblies.

Care should be taken to insure that nothing prohibits the operation of any moving parts. Damper panel limit switches should be checked to insure that they are signaling open and/or closed at each end of the damper open/closed cycle. Readjustment should be made to all switches that are not functioning properly.

B. Procedures for Starting, Operating and Stopping Dampers

Starting Procedure:

After all mechanical and electrical connections have been inspected and tightened as required, and there is no debris that will impede the movement of the damper blades or linkage, electrical supply can be provided to the actuator assemblies.

Operating Procedures:

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

When the damper has its electrical supply connected, the damper will assume its powered position when energized. This position will be held until the damper loses power. At that time the damper will return to its fail safe position as designated on the damper schedules. These dampers are designed for fail open.

The speed of the damper opening or closing is approximately 3-5 seconds.

NOTE OF CAUTION:

Actuator closing times can be fast. Caution should be used when around dampers that would open or close from a remote signal.

Stopping Procedures:

The dampers are designed as two position dampers. They will either remain open or closed as directed by the system controls. Damper components move during damper cycling. Be sure there are no foreign objects in the path of the blades and linkage before allowing the damper to be cycled.

C. Damper Post-Operation Inspection List

In general, the dampers must be kept clean and free from foreign matter that may impede normal movement and/or seating of the blades and seals. Therefore, dampers should be cleaned and inspected for general physical and mechanical condition. This inspection should include checking the mechanical tightness of bolted connections, visual inspection for the buildup of dirt or debris that may prevent damper closure and a general inspection for any obvious maintenance.

Inspect all connections holding the damper to the opening.

Inspect all fasteners holding actuator assemblies, splice plates, mullion covers, and limit switch mounting angles.

Damper blades, jamb seals, linkage pivots, etc. should be wiped clean to insure that dirt build up will not impede the operation of the damper.

Jamb seals should also be inspected for damage and to insure that they are sealing properly.

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

Once the dampers have been cleaned and thoroughly inspected, they should be cycled open and closed several times with their actuator assemblies.

Care should be taken to insure that nothing prohibits the operation of any moving parts. Damper panel limit switches should be checked to insure that they are signaling open and/or closed at each end of the damper open/closed cycle. Readjustment should be made to all switches that are not functioning properly.

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

Section V

Maintenance Information

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

V. Maintenance Information

A. Maintenance Schedule

Recommended Task	Frequency	Skill Level	Estimated Time (hrs)	Crew Size
Visually Inspect dampers and actuators for the build up of dirt, debris, wear and corrosion	Semi-annually	Basic	.25	1
Inspect jamb and blade seals for damage and proper sealing	Semi-annually	Basic	0.25	1
Perform operational checkout (including cycle testing – opening and closing the damper a few times under electrical power) and verify position status with the main control panel – This can be waived if dampers are cycled on a daily basis during normal use.	Monthly	Basic	0.25	2
Clean dirt and debris from the damper and actuators	Semi-annually	Basic	0.5	2
Inspect the dampers for premature corrosion	Semi-annually	Basic	0.25	1
Check tightness of mechanical connections	Semi-annually	Basic	0.25	2
Note: The above stated numbers are on a per damper basis.				
Note: Routine maintenace of GREENHECK supplied dampers does not require the use of special tools. Basic hardware tools are all that are required.				

B. Inspection and Adjustment Procedures

1. Visually Inspect dampers and actuators for the build up of dirt, debris, wear and corrosion

a. Overall visual inspection of the damper assembly. Look for exsesive dirt, dust or debris on damper blades and around damper linkages.

b. If construction is taking place near by, dampers should be covered as much as possible.

c. Remove any debris from within the damper or around damper linkages.

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

2. **Inspect jamb and blade seals for damage and proper sealing**

   a. Inspect jamb seals for premature wear or buckling. If any buckling is noticed, damper should be corrected immediately. This will prevent the damper from fully closing, thus not allowing it to perform its safety related function.

   b. Inspect the damper blade seals for damage. If damage is noticed, it should be replaced immediately.

3. **Perform operational checkout (including cycle testing) and verify position status with the main control panel – This can be waived if dampers are cycled on a daily basis during normal use**.

   Cycle dampers under power (20/1/60) to verify proper performance and operation. This should be done from the damper control panel to ensure all electrical connections are also functioning properly.

   At this time it should also be noted as to whether the damper limit switches are providing the proper feedback for both the open and closed position.

4. **Clean dirt and debris from the damper and actuators**

   Use a soft rag or towl to wipe away debris and dirt build ups on equipment as needed.

5. **Inspect the dampers for premature corrosion**

   Note: This procedure is very important and must be maintained to expect a 30 year life out of the dampers in this application.

   a. As stated in the Maintenance schedule of this manual, each damper should be inspected on a semi-annual basis for premature corrosion of the dampers.

   b. Visually inspect each panel frame, blades, actuator and jackshaft support stands, splice plates and all areas around fasteners for premature corrosion.

   c. If corrosion is noticed in the form of a "flaky" white substance around any fasteners, remove the fasteners, use a soft wire brush to remove the corrosion, touch-up the area with a zinc-rich paint (a minimum of 3 mils (0.0003 inches) is required), then reassemble the fastener.

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

d. If there is any corrosion noticed on any other areas of the galvanized steel, follow the same procedures as above.

6. Check tightness of mechanical connections

a. Manually check all the fasteners to ensure they are still tight. This can be done by checking with hands only. Generally if a fastener is loose, this will be a noticable check. Tighten all fasteners as necessary.

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

Maintenance Checklist Form

Maintenance Task	Task Completed
Visually Inspect dampers and actuators for the build up of dirt, debris, wear and corrosion	
Inspect jamb and blade seals for damage and proper sealing	
Perform operational checkout (including cycle testing – opening and closing the damper a few times under electrical power) and verify position status with the main control panel – This can be waived if dampers are cycled on a daily basis during normal use.	
Clean dirt and debris from the damper and actuators	
Inspect the dampers for premature corrosion	
Check tightness of mechanical connections	

Damper Tag No.: _____

Authorization Signatures:

Name: _____
Firm: _____ Date: _____

Name: _____
Firm: _____ Date: _____

Name: _____
Firm: _____ Date: _____

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

Section VI

Repair Information

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

VI. Repair Information

A. Corrective Maintenance Schedule

Required Task	Skill Level	Estimated Time (hrs)	Crew Size
Replace damper shaft bearing	Basic	3.0	2
Replace a blade edge seal	Basic	1.0	1
Replace a jamb seal	Basic	2.0	2
Replace damper actuator	Basic	1.0	2
Replace damper position switch	Basic	0.5	2
Replace a damper panel	Basic	2.5	2

1. Replace damper shaft bearing

a. To replace a shaft bearing, the damper shaft must be removed. To do this, the linkage pivot assembly will need to be
b. Disassemble the fastener connections holding the damper blade skins to the shaft
c. Slide the shaft out of the damper blade. Be prepared to support the blade when the shaft is removed.
d. Carefully remove the damaged shaft bearing by undoing the bolted connection. Caution should be taken not to damage the jamb seal, blade seals or blades.
e. Reinstall the new bearing assembly
f. Replace the shaft into the blade skin, and replace the bolted connection.
g. Rotate the blade so that the linkage pivot pin will be aligned with the linkage bar and replace the shoulder bolt pivot assembly.

2. Replace a blade edge seal

a. The damper blade seals are clipped on to the blade edges. If the seals are damaged, the seals can be removed, by prying the seals from the blades.
b. Cut new seal to the proper length of the blade requiring the new seal. Seal length should be the same as the blade length (+ 0.000 / - 0.032")
c. To install new seal, align the seal with the length of the blade.
d. Gently tap the seal on the blade edge with a hammer – caution should be exercised not to damage the seal during installation.

3. Replace a jamb seal

a. Although this can be done at the job site, it is not recommended. If a jamb seal

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

is damaged, it is recommended that the entire damper panel be removed and the jamb seal be replaced at a more workable work area.

b. To replace a jamb seal, ALL the damper blades need to be removed.
c. The linkage pivot assembly will need to be disconnected.
d. Disassemble the fastener connections holding the damper blade skins to the shaft
e. Slide the shaft out of the damper blade. Be prepared to support the blade when the shaft is removed.
f. Carefully remove the damaged jamb seal. Tape the new seal into place until the repair is complete.
g. Replace the shaft into the blade skins, and replace the bolted connection.
h. Remove the tape that was used to hold the seal in place
i. Rotate the blade so that the linkage pivot pin will be aligned with the linkage bar and replace the shoulder bolt pivot assembly.

4. Replace damper actuator

a. The damper actuator connects directly to an extended drive shaft with the use of an intermediate coupling which is welded to the drive shaft and keyed for the actuator operation
b. **Caution: be sure all electrical power is disconnected before beginning this work**.
c. The actuator is supplied with a thermal blanket to maintain operational integrity at 482°F for one hour. This blanket needs to be removed by unlatching the cinch straps provided on the outside of the thermal blanket.
d. Disconnect the wiring from actuator terminal per the Actuator Operation and Instruction Manual. See section VII of this manual.
e. The actuator is secured to the mounting channel with (4) bolts. While supporting the actuator weight, remove the (4) bolts.
f. The actuator will slide out – perpendicular to the actuator mount.
g. The shaft inside the actuator has a machined keyway and key stock. Be sure to locate and keep the key to reinstall the actuator.
h. Locate new actuators and verify the actuator that was removed and the new actuator have the same model number and rotation.
i. Carefully slide the actuator back on to the damper coupling, locating the keyway and key stock as it was disassembled.
j. Secure the actuator with the (4) bolts
k. Reconnect the electrical power per the Actuator Operation and Instruction Manual – See section VII of this manual.
l. Cycle the damper several times to ensure proper operation. See Recommissioning Procedure in this section of the manual.

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

5. **Replace damper position switch**
    a. Proximity Controls Model 44TL0 limit switch is used.
    b. **Caution: be sure all electrical power is disconnected before beginning this work.**
    c. Disconnect the wiring using local codes and standards
    d. Disconnect the linkage connection at the limit switch.
    e. The limit switch is attached with (2) bolts. Disconnect the limit switch from its mounting location.
    f. Disconnect the galvanized arm which is attached the limit switch bottom.
    g. Reconnect the arm to the new switch
    h. Fasten the new switch to the mounting location
    i. Reconnect the linkage connection
    j. Reconnect with wiring
    k. Cycle the damper to verity all connections have been properly made.

6. *Replace a damper panel*
    a. Identify which damper panel (or module) is to be removed prior to beginning.
    b. Once identified, remove fasteners securing the section to the opening.
    c. NOTE – SOME LIFTING DEVISE SHOULD BE ATTACHED TO THE DAMPER PANEL PRIOR TO REMOVING FASTENERS TO SUPPORT THE DAMPER WEIGHT ONCE REMOVED.
    d. The panel to be removed can then be unbolted from the supporting steel work and lifted out of its position.
    e. The new replacement panel can be set in the same spot, reconnect the bolted mullion cover first.
    f. Secure the damper to the supporting steel work using its bolted connection.

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

B. Damper Ordering Information

To order replacement dampers or components, contact the sales department at:

Greenheck Fan Corporation
PO Box 410
Schofield, Wisconsin, USA 54476

Phone: 715-359-6171
Fax: 715-355-3189

Project Number: T243

Please have the following information available when making inquiries:

1) Job Name: Lytle Tunnel Project

2) Equipment Tag # and Damper Location

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

C. Recommissioning Procedure:

1. Each damper shall be subjected to rotational reversal tests. A cycle of rotation reversal is defined as reversal from fully open to fully closed positions, and then back to fully open position. Each damper shall require 5 cycles of rotation reversal.

2. After completion of reversal tests, the power supply of each damper operator shall be removed and checked to ensure that the damper is driven to its "fail safe" position within 5 seconds after the power supply is removed.

3. The attached form shall be filled out, in full, by the person performing the above tasks.

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

Damper Commissioning Form

Station or Shaft Location: _____
Damper Tag No.: _____

1. Inspect damper to insure that it is properly installed. Check that the damper reaches full open and full closed positions and that the limit switches are properly contacted and relaying a signal back to the control room. Record observations below.

_____

_____

_____

_____

_____

_____

_____

2. Five (5) cycle reversal test

   Check if completed

3. De-energized (Power supply off) Closure/Opening time _____ seconds.
   Energized (Power supply on) Closure/Opening time _____ seconds

Authorization Signatures:

Name: _____
Firm: _____ Date: _____

Name: _____
Firm: _____ Date: _____

Name: _____
Firm: _____ Date: _____

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

Section VII

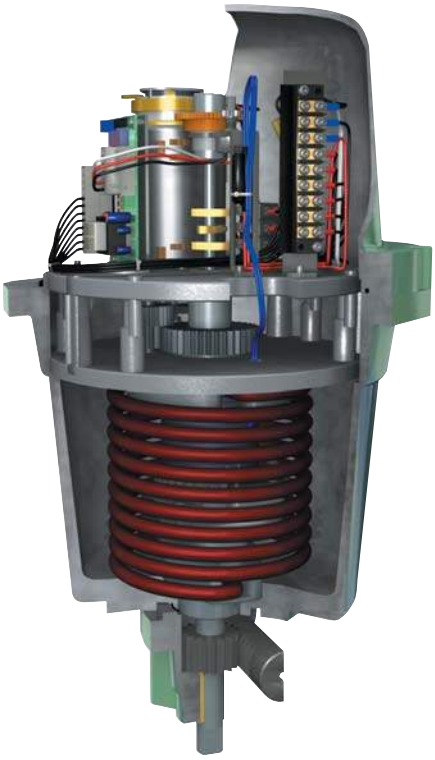
Damper Actuator Maintenance and Operation Information

SPRING RETURN ELECTRIC

Not Available With Manual Override

NEMA 4/6/7 Enclosure
Approvals
A.C. Models Only *Canadian Standards Association* CSA NRTL/C—Enclosure 4 CSA NRTL/C—Class I, Divisions 1 & 2, Groups C & D CSA NRTL/C—Class II, Divisions 1 & 2, Groups E, F & G CSA NRTL/C—Approved to UL standard No. 429, Electrically Operated Valves CSA NRTL/C—Approved to UL Standard No. 1203, Electrical Equipment for use in Explosion - proof And Dust - Ignition - proof Hazardous (Classified) Locations

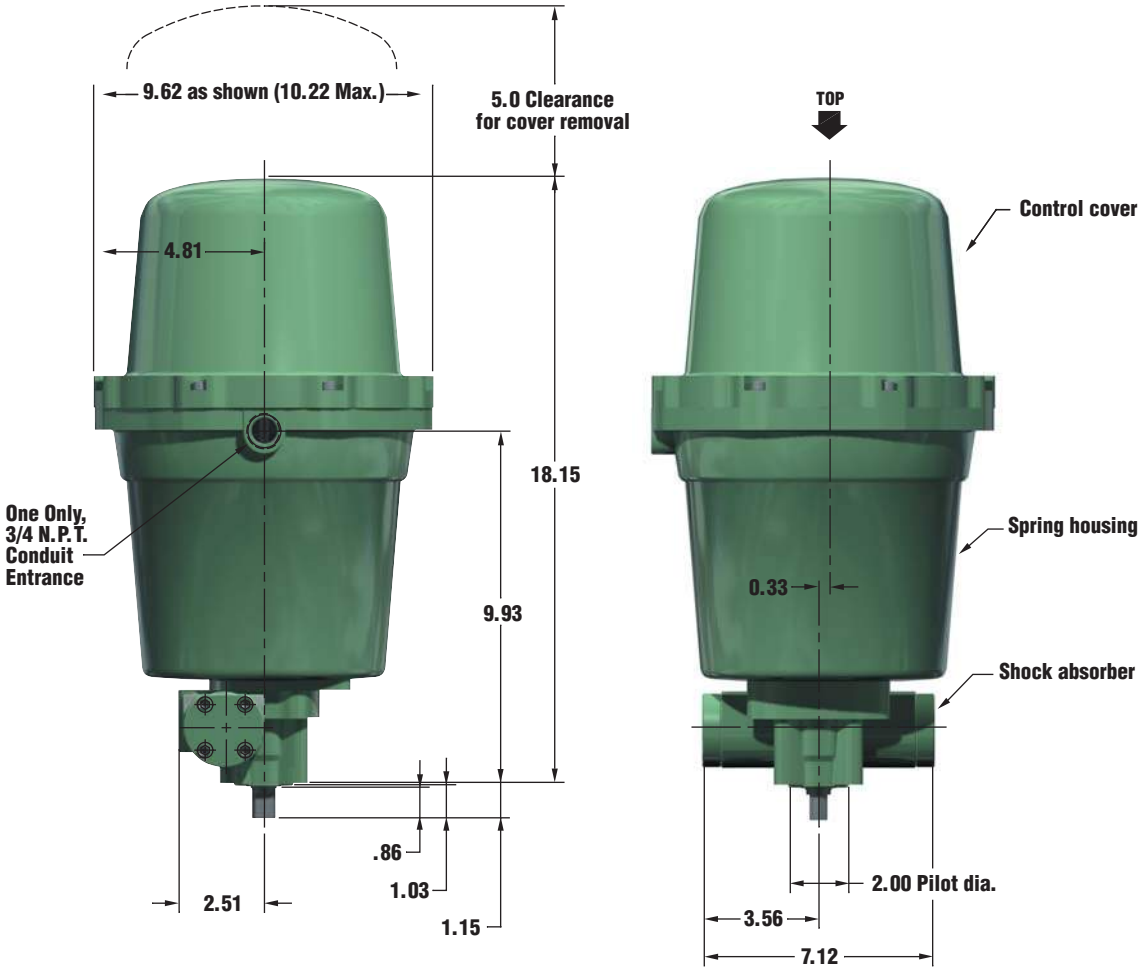
Model
SURE49
Typical Application
For on/off and modulating control of: • **Part turn ball, butterfly, plug valves or rotary dampers when emergency shutdown or shutoff capability is required in the event of a loss of power.**
Temperature Range
Standard: -40°F to +150°F **-40°C to +65°C** **Optional: -60°F to +150°F** **-50°C to +65°C** **Optional:** **Compliance to NFPA 130, capable of operation after exposure to ambient temperature of 482°F (250°C) for a minimum of 1 hour.**
Voltage
115 VAC, 1 Phase, 50/60 Hz. **230 VAC, 1 Phase, 50/60 Hz.** **24 VAC, 1 Phase, 50/60 Hz.** **12VDC, 24VDC**
Torque Range
600 pound inches spring end (68 newton meters)
Speed Range
5, 15 & 30 seconds for 90° revolution, motor operation **2 to 5 seconds, spring operation**
Spring
Helical torsion spring, spring steel, XYLAN® coated
Standard Features
AC Voltages **4 – SPDT Switches, PTC Heater, Motor Brake** **DC Voltages** **2 – SPDT (High Current) Switches, PTC Heater, Motor Brake**



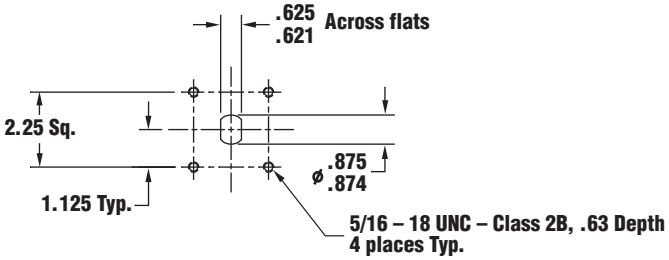
SPRING RETURN ELECTRIC

Outline Dimensions (Inches) — (SURE 49)

Weight
49 pounds / 22.27 kg



Mounting Geometry — Bottom View



Notes

1. Direction of rotation is based on viewing actuator from top.
2. Actuator shown in energized position.

SPRING RETURN ELECTRIC

115 & 230 VAC, 1 Phase, 50/60 Hz.

SURE POWER

Model	Output Torque Inch Pounds (N.m)	Electrical Speed of Operation — 60 Hz. (50 Hz.)	Spring Speed of Operation	Duty Cycle Rating 115 VAC	Duty Cycle Rating 220 VAC	Current Ratings 115 VAC		Current Ratings 220 VAC	
						N.L.A.*	L.R.A.*	N.L.A.*	L.R.A.*
Sure 25-5	300 (34)	5 seconds/90° (6 seconds/90°)	2 seconds/90°	50% (1)	50% (1)	1.40	2.15	CF**	CF**
Sure 25-10	300 (34)	10 seconds/90° (12 seconds/90°)	2 seconds/90°	50% (2)	50% (2)	1.00	1.55	CF**	CF**
Sure 24-10	300 (34)	10 seconds/90° (12 seconds/90°)	2 seconds/90°	25% (1)	25% (1)	.70	1.05	.45	.65
Sure 49-5	600 (68)	5 seconds/90° (6 seconds/90°)	2 seconds/90°	25% (1)	25% (1)	1.10	1.80	1.00	1.20
Sure 49-15	600 (68)	15 seconds/90° (18 seconds/90°)	2 seconds/90°	25% (1)	25% (1)	.55	1.55	.35	.90
Sure 49-30	600 (68)	30 seconds/90° (35 seconds/90°)	2 seconds/90°	50% (2)	50% (2)	.65	.70	.30	.35
Sure 100-10	1,200 (136)	10 seconds/90° (12 seconds/90°)	5 seconds/90° (max) +	25% (1)	25% (1)	1.90	2.90	.90	1.35
Sure 100-30	1,200 (136)	30 seconds/90° (35 seconds/90°)	7 seconds/90° (max) +	50% (2)	50% (2)	.65	.95	.35	.45
Sure 150-15	1,800 (136)	15 seconds/90° (18 seconds/90°)	5 seconds/90° (max) +	25% (1), (2)	25% (1), (2)	1.90	2.90	.90	1.35

* (N.L.A.) — No Load Ampere (L.R.A.) — Locked Rotor Ampere (1) — Open/Close Service (2) — Open/Close or Modulating Service
** (CF) — Consult Factory + — Approximate, Based on Load

24 VAC

SURE POWER

Model	Output Torque Inch Pounds (N.m)	Electrical Speed of Operation — 60 Hz. (50 Hz.)	Spring Speed of Operation	Duty Cycle Rating 24 VAC	Current Ratings 24 VAC	
					N.L.A.*	L.R.A.*
Sure 49-30	600 (68)	30 seconds/90° (35 seconds/90°)	2 seconds/90°	25% (2)	4.50	5.00

12 & 24 VDC

SURE POWER

Model	Output Torque Inch Pounds (N.m)	Electrical Speed of Operation	Spring Speed of Operation	Duty Cycle Rating 12 VDC	Duty Cycle Rating 24 VDC	Current Ratings 12 VDC		Current Ratings 24 VDC	
						N.L.A.*	L.R.A.*	N.L.A.*	L.R.A.*
Sure 49-5	600 (68)	5 seconds/90°	2 seconds/90° (1)	50% (1)	50%	1.00	22.00	1.00	12.30

Limit Switches (Sure 24 & 25)

Standard: Two-single pole, double throw type (SPDT) with an option: for 2 or 4 additional

Limit Switches (24 VDC Models)

Ratings: UL and CSA listed.
MIL-PRF-8805 Qualified Listing
25 amp at 277 VAC; 1 H.P. at 125 VAC;
2 H.P. at 250 VAC

Isolation Relays

To operate multiple actuators in parallel from a single signal requires isolating relays in the field wiring. Consult factory.

Limit Switches (Sure 49, 100 & 150)

Standard: Four-single pole, double throw type (SPDT) with an option: for 2 additional

Ratings: UL and CSA listed.
15 amp & 1/2 H.P. at 125 or 250 VAC;
1/2 amp at 125 VDC; 1/4 amp at 250 VDC;
Lamp Load - 5 amp at 120 VAC

Optional: All double pole, double throw type (DPDT).

Ratings: UL and CSA listed.
10 amp at 125/250 VAC (form ZZ);
1/2 H.P. at 125 VDC; 3/4 H.P. at 250 VAC

Heater

PTC (Positive Temperature Coefficient)
Heater Standard in all A. C. Voltage Models

Duty Cycle

The percentage of time the electric motor is energized vs. the time it is at rest, in reversing duty and with the actuator running at it's rated load - maximum published torque.

Standard Modulating Duty Rating

- 12 motor starts (corrections) per minute.
- At the rated duty cycle for that model.
- With the speed of operation a minimum of 15 seconds for 90° or slower.
- With positioning accuracy of (+/-) 1% of total span.

SUREPOWR™ SERIES - SURE 49

FIELD INSTALLATION INSTRUCTIONS

Safety First

In the maintenance and operation of mechanical equipment, SAFETY is the basic factor which must be considered at all times. Through the use of the proper clothes, tools and methods of handling, serious accidents causing injury to you or your fellow workers can be prevented.

Throughout this manual are listed a number of safety precautions. Study them carefully and follow them; also insist that those working for you do the same. Remember, an accident is usually caused by someone's carelessness, neglect or oversight.

CAUTION **To prevent ignition of hazardous atmospheres, do not remove actuator cover while circuits are live.** **CAUTION**

CAUTION **Loaded spring inside actuator. Do not attempt to repair actuator below top gear plate, unless properly trained on repair methods.** **CAUTION**

Installation

Note: SurePowr actuators can be supplied for clockwise or counter-clockwise spring driven rotation (viewed from the top of the actuator). The spring drive rotation is noted on the actuator name tag and wiring diagram. Ensure that the actuator has been supplied with the proper spring drive operation for the application prior to installation on the driven device.

1. The actuator is shipped in the power off (fail) position. Ensure that the driven device is oriented to its fail position prior to installation of the actuator.
2. Care should be taken to maintain proper alignment between the actuator and the device shaft. If the actuator is not in the correct alignment with the device shaft, repeat the procedure in Step 1.
3. Mount the actuator to the device. Ensure the actuator is centered properly with the device shaft, and then tighten all bolts and nuts evenly.
4. Remove the cover bolts located around the actuator motor and control cover flange.
5. Terminate field wiring per the appropriate RCS wiring diagram, supplied with the actuator. Use a minimum of #18 AWG stranded wire.

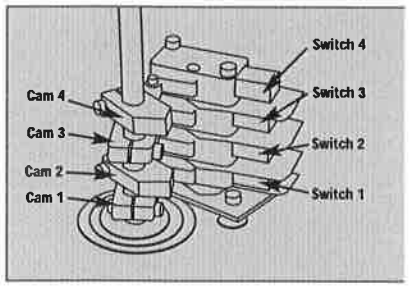


Figure 1

Switch adjustments for clockwise spring fail operation (viewed from the top of the actuator)

a. Ensure actuator is de-energized and positioned in the clockwise (fail) position. Loosen the setscrews on Cams 1 and 3. Rotate both counter-clockwise until they clear the switch arm rollers of Switches 1 and 3.
b. Rotate Cam 1 clockwise until it comes in contact with Switch 1's arm roller and the switch "breaks". A light "click" can be heard. Tighten the set-screws on Cam 1.
c. Rotate Cam 3 clockwise until it comes in contact with Switch 3's arm roller and the switch just "breaks". A light "click" can be heard.
d. Rotate Cam 3 slightly further in the clockwise direction. (This ensures that Switch 3 will "break" just prior to the actuator reaching the full fail position.) Tighten the setscrews on Cam 3. Energize the actuator. This will move the actuator to the opposite end of travel.
e. Upon reaching the opposite end of travel, Cam 2 should just engage the roller on Switch 2 so that the switch just "breaks". This action will stop the actuator. Check that the actuator has properly positioned the driven equipment.
f. If actuator travel is insufficient, rotate Cam 2 slightly clockwise until the cam just clears the roller of Switch 2. As soon as the cam clears the roller, the actuator will "bump" electrically towards the end of travel. Continue until the actuator reaches the full end of travel.

CAUTION **Closely monitor the electrical stroke, as the travel limit switches are not yet properly adjusted. Ensure the actuator does not over-travel and damage the driven equipment.** **CAUTION**

g. If the actuator has over-traveled, rotate Cam 2 slightly counter-clockwise, then move the actuator towards the fail position electrically. Stop and electrically reverse the direction of travel. Move the actuator until Cam 2 operates Switch 2 and the actuator stops. Repeat this procedure until the actuator is properly positioned.
h. Rotate Cam 4 until it comes in contact with Switch 4's arm roller and the switch just "breaks". A light "click" can be heard. Rotate the cam slightly counter-clockwise. (This ensures that Switch 4 will "break" just prior to the actuator reaching the extreme opposite end of travel.) Tighten the setscrews on Cams 2 and 4.

Switch adjustments for counter-clockwise spring fail operation (viewed from the top of the actuator)

a. Ensure the actuator is de-energized and positioned in the counter-clockwise (fail) position. Loosen the setscrews on Cams 2 and 4. Rotate both clockwise until they clear the switch arm rollers of switches 2 and 4.
b. Rotate Cam 2 counter-clockwise until it comes in contact with Switch 2's roller arm and the switch "breaks". A light "click" can be heard. Tighten the setscrews on Cam 2.
c. Rotate Cam 4 counter-clockwise until it comes in contact with Switch 4's arm roller and the switch just "breaks". A light "click" can be heard.
d. Rotate Cam 4 slightly further in the counter-clockwise direction. (This ensures that Switch 4 will "break" just prior to the actuator reaching the full fail position.) Tighten the setscrews on Cam 4. Energize the actuator. This will move the actuator to the opposite end of travel.

CAUTION **Closely monitor the electrical stroke, as the travel limit switches are not yet properly adjusted. Ensure the actuator does not over-travel and damage the driven equipment.** **CAUTION**

e. Upon reaching the opposite end of travel, Cam 1 should just engage the roller on Switch 1 so that the switch just "breaks". This action will stop the actuator. Check that the actuator has properly positioned the driven equipment.
f. If actuator travel is insufficient, rotate Cam 1 slightly counter-clockwise until the cam just clears the roller of Switch 1. As soon as the cam clears the roller, the actuator will "bump" electrically towards the end of travel. Continue until the actuator reaches the full end of travel.If the actuator has over-traveled, rotate Cam 1 slightly counter-clockwise, then move the actuator towards the fail position electrically. Stop and electrically reverse the direction of travel. Move the actuator until Cam 1 operates switch 1 and the actuator stops. Repeat this procedure until the actuator is properly positioned.
g. If the actuator has over-traveled, rotate Cam 1 slightly clockwise, then move the actuator towards the fail position electrically. Stop and electrically reverse the direction of travel. Move the actuator until Cam 1 operates switch 1 and the actuator stops. Repeat this procedure until the actuator is properly positioned.
h. Rotate Cam 3 until it comes in contact with Switch 3's arm roller and the switch just "breaks". A light "click" can be heard. Rotate the cam slightly further in the clockwise direction. (This ensures that Switch 3 will "break" just prior to the actuator reaching the extreme opposite end of travel.) Tighten the setscrews on Cams 1 and 3.

6. Operate the actuator electrically several times to ensure proper operation and to verify that travel limits and stops are correctly set.
7. De-energize the actuator to verify proper spring failure operation. Ensure the driven device is properly positioned in the spring failure position.
8. If the actuator is supplied with an optional feedback potentiometer and/or position controller, verify proper calibration of input and output signals after making cam adjustments.
9. Replace the actuator cover and cover screws.
10. The actuator is now ready for electrical operation.

WIRING DIAGRAMS

CCW Spring Return Rotation As Viewed From Top of Actuator

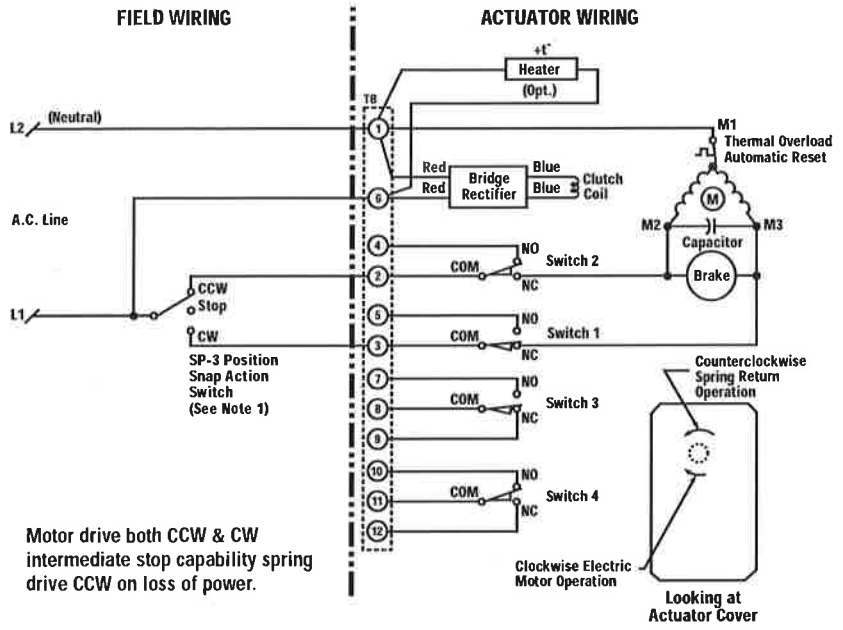


Figure 2 (For Illustration Purposes only)

Operation Notes:

A. Power to terminal 1 & 3 will motor drive and brake hold actuator in CW most position.

B. Power to terminal 1 & 2 will motor drive and spring hold actuator in CCW most position.

C. Loss of power will spring drive and spring hold actuator in CCW most position.

CW Spring Return Rotation As Viewed From Top of Actuator

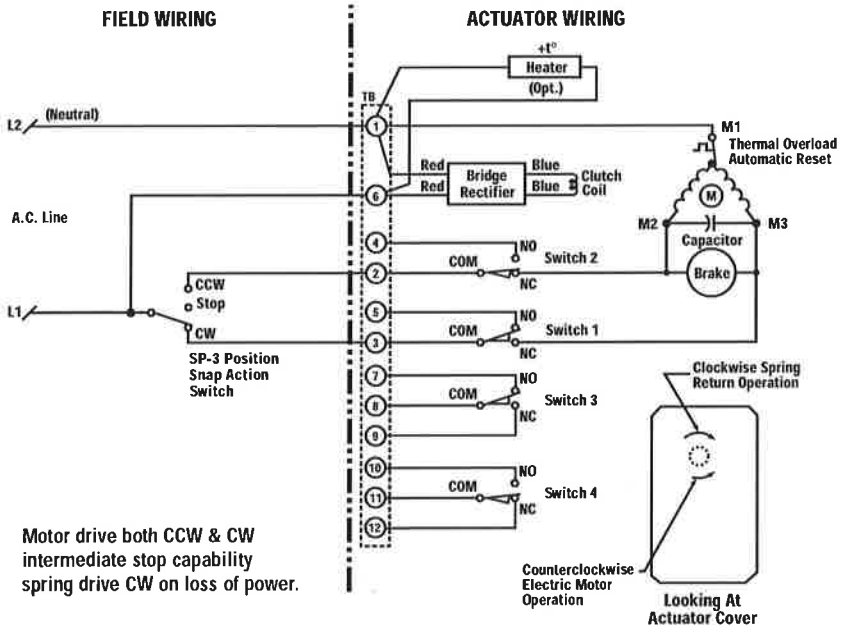


Figure 3 (For Illustration Purposes only)

Operation Notes:

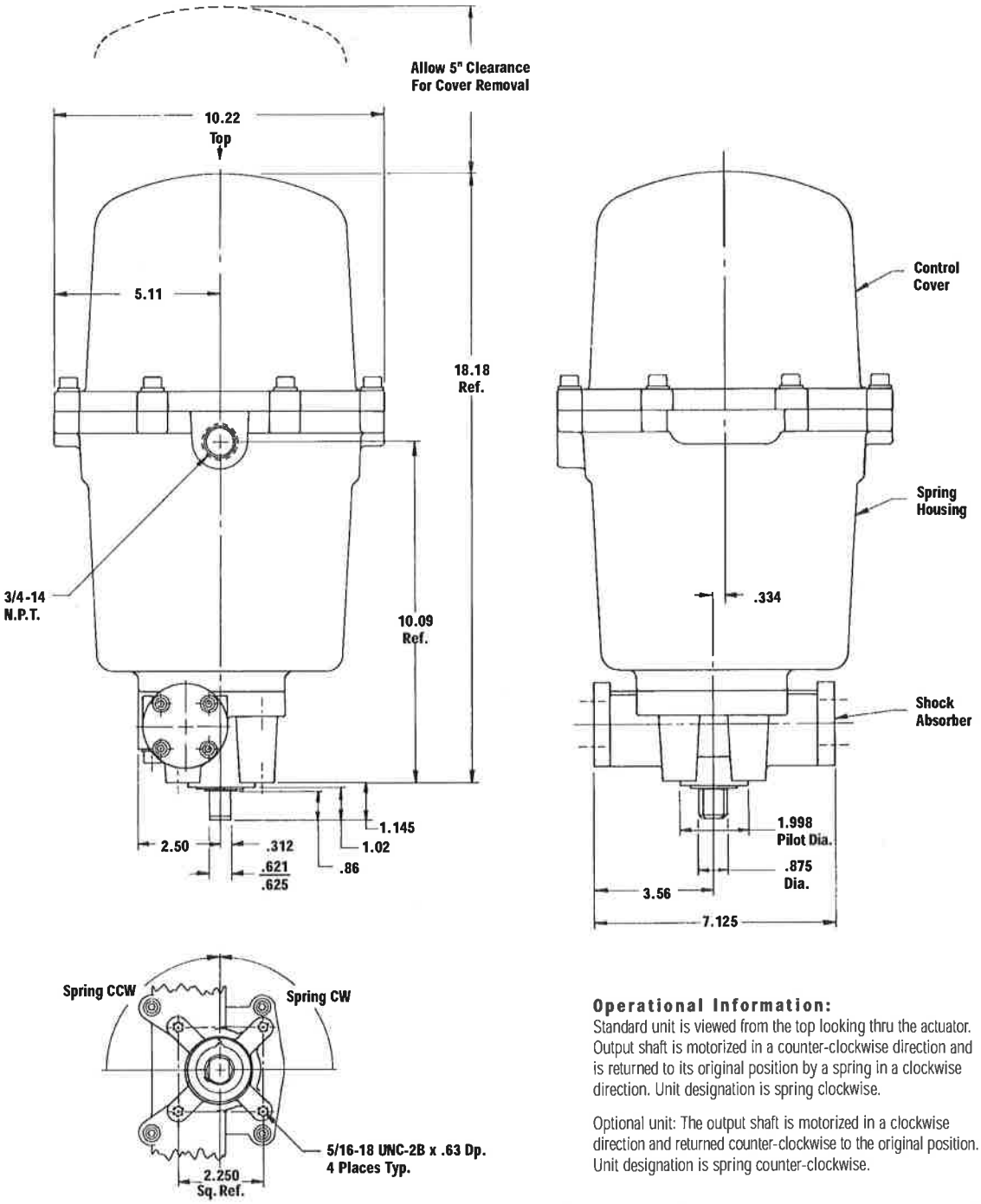
A. Power to terminal 1 & 2 will motor drive and brake hold actuator in CCW most position.

B. Power to terminal 1 & 3 will motor drive and spring hold actuator in CW most position.

C. Loss of power will spring drive and spring hold actuator in CW most position.

SURE 49

NEMA 4, 6, AND 7 DIMENSIONAL INFORMATION



Operational Information:

Standard unit is viewed from the top looking thru the actuator. Output shaft is motorized in a counter-clockwise direction and is returned to its original position by a spring in a clockwise direction. Unit designation is spring clockwise.

Optional unit: The output shaft is motorized in a clockwise direction and returned counter-clockwise to the original position. Unit designation is spring counter-clockwise.

Figure 4

CAUTION

To prevent ignition of hazardous atmospheres, do not remove actuator cover while circuits are live.

CAUTION

Operation

Power On: The electric motor drives the gear train, which in turn winds the spring and turns the device. An internal limit switch de-energizes the motor and the brake, which holds the return spring and device in position.

Power Off: When the current is interrupted by either a control signal or a power failure, the return spring drives the device to its original position.

Note: It is recommended that the actuator be driven electrically in both directions for normal operation to prolong cycle life.

Maintenance

Gear train is permanently lubricated at the factory for the average life of the actuator. Brake gap is set at the factory. No further attention is required.

Thermal Overload

The internal thermal overload switch de-energizes the motor and prevents overheating of the motor windings due to excessive operation, stalling or high ambient temperatures.

Duty Cycle

The maximum duty-cycle to be expected without interruption by thermal cut-off at an ambient temperature of 65C° is 25% (3 "OFF" times for every 1 "ON" time) for the 5 and 10 second design, and 50% (1 "OFF" time for every 1 "ON" time) for the 30 second design.

Storage

The Surepowr actuator must be stored in a clean, dry, temperature controlled building which is protected from the weather. Precautions shall be taken to prevent condensation inside or outside the actuator. If there is insufficient external temperature and humidity control, internal heaters must be installed and energized to protect the unit against condensation from extreme temperature variations. The actuators shall be stored off the floor on suitable pallets and must be covered with an unsealed dust protector allowing side and bottom ventilation.

Troubleshooting (New Unit)

Note: Most actuator problems occur due to incorrect cam/travel limit switch setting, or the use of an external travel stop on the device that the actuator is operating.

Problem 1: Actuator is receiving electric power but the motor does not respond.

Instructions:

1a. Check actuator nameplate to insure correct model, voltage type and spring return direction.

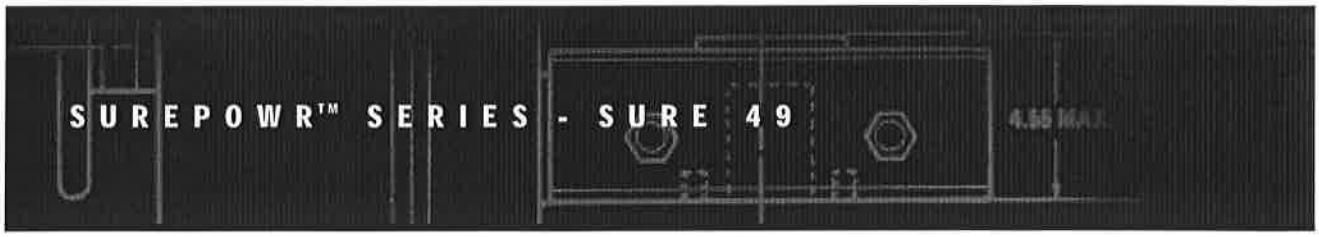
1b. Check all wiring against installation wiring diagram.

1c. **Actuator with clockwise fail position:** Using a volt meter, check that power is available between terminals 1 and 2. Then check the voltage between terminal 1 (common) and the two legs of the motor and capacitor. The meter should indicate a value = to or greater than the supply voltage indicated on the actuator nametag.

Actuator with counter-clockwise fail position: Using a volt meter, check that power is available between terminals 1 and 3. Then check the voltage between terminal 1 (common) and the two legs of the motor and capacitor. The meter should indicate a value = to or greater than the supply voltage indicated on the actuator nametag.

If power is not present at the motor or capacitor leads:

- Cam adjustments are required
- Switch malfunction
- Improper wiring



Problem 2: Actuator is receiving electric power but the motor only hums.
Instructions: 2a. Perform steps 1a through 1c listed above.
2b. Check to insure brake is completely disengaged when power is applied.

Problem 3: Actuator runs but operation is erratic.
Instructions: 3a. Perform steps 1a through 1c listed above.
3b. Check ambient temperature. Standard Surepowr actuators have a maximum ambient operating temperature rating of 65°C.
3c. Check duty cycle (frequency of operation). See above for details.
3d. Ensure that actuator is not continuously stalled.

Problem 4: Motor runs continuously in spring return direction after actuator output shaft has stopped.
Instructions: 4a. Adjust spring return side travel cam/switch so that the cam trips the switch before shaft stops motion.

Problem 5: Motor runs continuously but output shaft does not turn.
Instructions: 5a. Check for power to the bridge rectifier and clutch solenoid.

Note: Standard Surepowr actuators are manufactured with thermal overload protectors in series with the motor common. Should any of the above problems cause the protector to open, it will automatically reset when the motor temperature is lowered to a safe level.

Locating and Ordering Parts

For ease and accuracy in identifying and ordering spare or replacement parts, submit the following information from unit nameplate.

1. Serial Number
2. Model Number
3. Voltage

Bulletin No. 6005
1M 7/01 SPI

1020 Rankin Rd., Houston, TX 77073
P.O. Box 60706, Houston, TX 77205
Tel: (281) 443-7000
Fax: (281) 443-6308
Fax: (281) 443-4802

Sure 100

Optional Manual Override Available

NEMA 4/6/7 Enclosure
Approvals
A.C. Models Only *Canadian Standards Association* CSA NRTL/C—Enclosure 4 and 6 CSA NRTL/C—Class I, Divisions 1 & 2, Groups C & D CSA NRTL/C—Class II, Divisions 1 & 2, Groups E, F & G CSA NRTL/C—Approved to UL standard No. 429, Electrically Operated Valves CSA NRTL/C—Approved to UL Standard No. 1203, Electrical Equipment for use in Explosion - proof And Dust - Ignition - proof Hazardous (Classified) Locations

Models
SURE100
Typical Application
For on/off and modulating control of: • **Part turn ball, butterfly, plug valves or rotary dampers when emergency shutdown or shutoff capability is required in the event of a loss of power.**
Temperature Range
Standard: -40°F to +150°F **-40°C to +65°C** **Optional: -60°F to +150°F** **-50°C to +65°C** **Optional:** **Compliance to NFPA 130, capable of operation after exposure to ambient temperature of 482°F (250°C) for a minimum of 1 hour.**
Voltage
115 VAC, 1 Phase, 50/60 Hz. **230 VAC, 1 Phase, 50/60 Hz.**
Torque Range
1200 pound inches spring end (136 newton meters)
Speed Range
10 & 30 seconds for 90° revolution, motor operation **5 to 7 seconds, spring operation**
Spring
Helical torsion spring, spring steel, XYLAN® coated
Special Features
AC Voltages **4 – SPDT Switches, PTC Heater, Motor Brake**

115 & 230 VAC, 1 Phase, 50/60 Hz.

SUREPOWR

Model	Output Torque Inch Pounds (N.m)	Electrical Speed of Operation — 60 Hz. (50 Hz.)	Spring Speed of Operation	Duty Cycle Rating 115 VAC	Duty Cycle Rating 220 VAC	Current Ratings 115 VAC		Current Ratings 220 VAC	
						N.L.A.*	L.R.A.*	N.L.A.*	L.R.A.*
Sure 25-5	300 (34)	5 seconds/90° (6 seconds/90°)	2 seconds/90°	50% (1)	50% (1)	1.40	2.15	CF**	CF**
Sure 25-10	300 (34)	10 seconds/90° (12 seconds/90°)	2 seconds/90°	50% (2)	50% (2)	1.00	1.55	CF**	CF**
Sure 24-10	300 (34)	10 seconds/90° (12 seconds/90°)	2 seconds/90°	25% (1)	25% (1)	.70	1.05	.45	.65
Sure 49-5	600 (68)	5 seconds/90° (6 seconds/90°)	2 seconds/90°	25% (1)	25% (1)	1.10	1.80	1.00	1.20
Sure 49-15	600 (68)	15 seconds/90° (18 seconds/90°)	2 seconds/90°	25% (1)	25% (1)	.55	1.55	.35	.90
Sure 49-30	600 (68)	30 seconds/90° (35 seconds/90°)	2 seconds/90°	50% (2)	50% (2)	.65	.70	.30	.35
Sure 100-10	1,200 (136)	10 seconds/90° (12 seconds/90°)	5 seconds/90° (max) +	25% (1)	25% (1)	1.90	2.90	.90	1.35
Sure 100-30	1,200 (136)	30 seconds/90° (35 seconds/90°)	7 seconds/90° (max) +	50% (2)	50% (2)	.65	.95	.35	.45

* (N.L.A.) — No Load Ampere (L.R.A.) — Locked Rotor Ampere (1) — Open/Close Service (2) — Open/Close or Modulating Service
** (CF) — Consult Factory + — Approximate, Based on Load

24 VAC

SUREPOWR

Model	Output Torque Inch Pounds (N.m)	Electrical Speed of Operation — 60 Hz. (50 Hz.)	Spring Speed of Operation	Duty Cycle Rating 24 VAC	Current Ratings 24 VAC	
					N.L.A.*	L.R.A.*
Sure 49-30	600 (68)	30 seconds/90° (35 seconds/90°)	2 seconds/90°	25% (2)	4.50	5.00

24 VDC

SUREPOWR

Model	Output Torque Inch Pounds (N.m)	Electrical Speed of Operation — 60 Hz. (50 Hz.)	Spring Speed of Operation	Duty Cycle Rating 115 VAC	Duty Cycle Rating 230 VAC	Current Ratings 12 VDC		Current Ratings 24 VDC	
						N.L.A.*	L.R.A.*	N.L.A.*	L.R.A.*
Sure 49-5	600 (68)	5 seconds/90° (6 seconds/90°)	2 seconds/90°	50% (1)	50% (1)	1.00	22.00	1.00	12.30

Limit Switches (Sure 24 & 25)

Standard: Two-single pole, double throw type (SPDT) with an option: for 2 or 4 additional

Limit Switches (24 VDC Models)

Ratings: UL and CSA listed.
MIL-PRF-8805 Qualified Listing
25 amp at 277 VAC; 1 H.P. at 125 VAC;
2 H.P. at 250 VAC

Isolation Relays

To operate multiple actuators in parallel from a single signal requires isolating relays in the field wiring. Consult factory.

Limit Switches (Sure 49 & 100)

Standard: Four-single pole, double throw type (SPDT) with an option: for 2 additional

Ratings: UL and CSA listed.
15 amp & 1/2 H.P. at 125 or 250 VAC;
1/2 amp at 125 VDC; 1/4 amp at 250 VDC;
Lamp Load - 5 amp at 120 VAC

Optional: All double pole, double throw type (DPDT).

Ratings: UL and CSA listed.
10 amp at 125/250 VAC (form ZZ);
1/2 H.P. at 125 VDC; 3/4 H.P. at 250 VAC

Heater

PTC (Positive Temperature Coefficient)
Heater Standard in all A. C. Voltage Models

Duty Cycle

The percentage of time the electric motor is energized vs. the time it is at rest, in reversing duty and with the actuator running at it's rated load - maximum published torque.

Standard Modulating Duty Rating

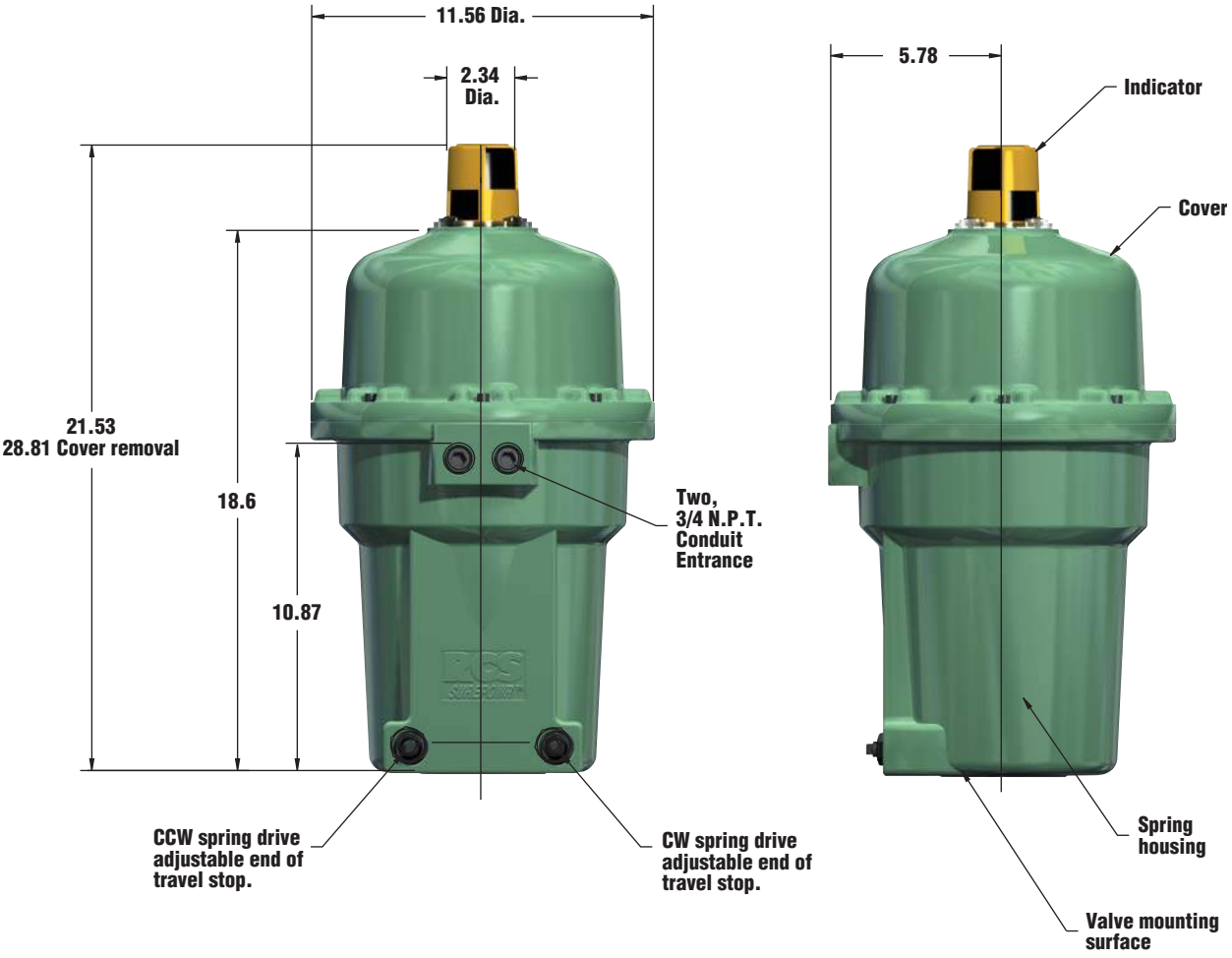
- 12 motor starts (corrections) per minute.
- At the rated duty cycle for that model.
- With the speed of operation a minimum of 15 seconds for 90° or slower.
- With positioning accuracy of (+/-) 1% of total span.

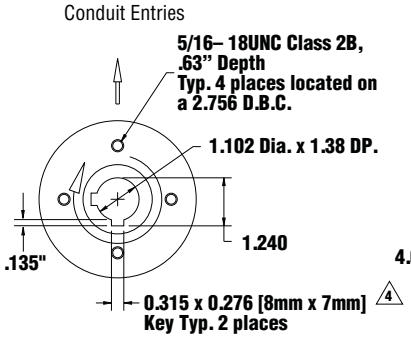
Dresser Industrial Products Group, Dresser, Inc.
16240 Port Northwest Dr., Houston, TX 77041-2645
Tel: Toll Free 800.945.9898 • 832.590.2306 • Fax: 713.849.2879
rcs@dresser.com • www.rcsactuators.com

SPRING RETURN ELECTRIC

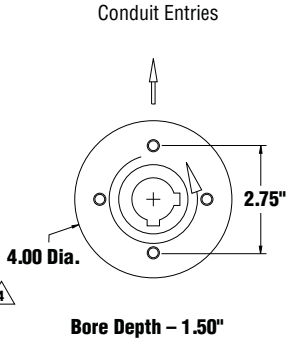
Outline Dimensions (Inches) — (SURE 100)

Weight
70 pounds/31.8 kg





CCW Spring Return



CW Spring Return

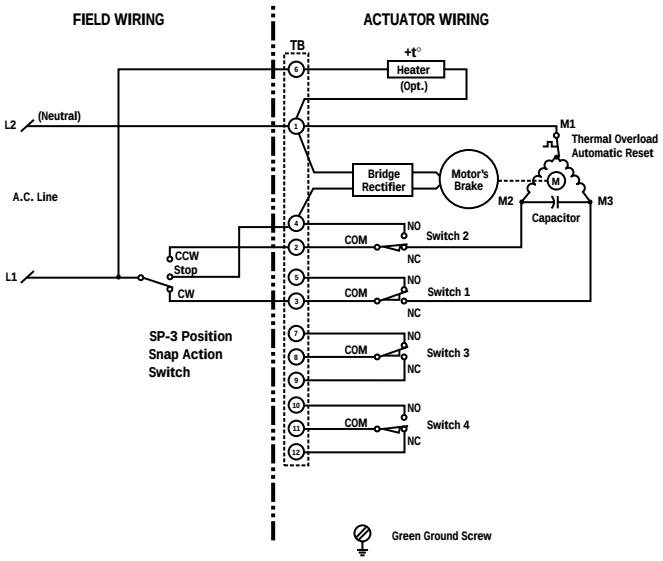
Notes

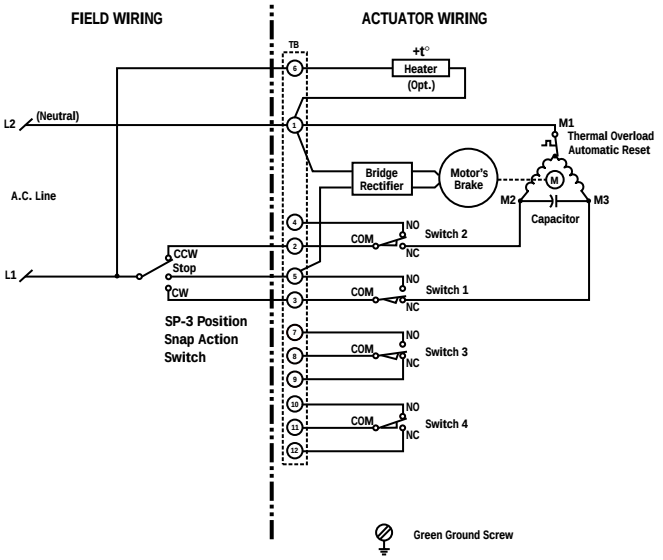
1. Direction of rotation is based on viewing actuator from top.
2. Actuator shown in power fail position.
3. Mounting circle complies with ISO 5211 flange type F07 (except bolt thread). Bolt circle is on center line, not straddling center line.

4. Two keys are recommended for driving device.


TYPE
SR

TYPE
SR

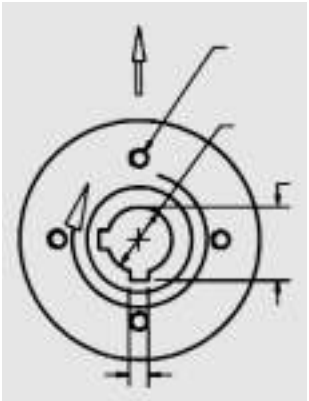

FIELD WIRING
ACTUATOR WIRING
TB
+t°
Heater
(Opt.)
L2
(Neutral)
A.C. Line
L1
M1
Thermal Overload
Automatic Reset
Bridge
Rectifier
Motor's
Brake
M2
M3
Capacitor
CCW
Stop
CW
COM
NO
NC
Switch 2
Switch 1
Switch 3
Switch 4
SP-3 Position
Snap Action
Switch
Green Ground Screw

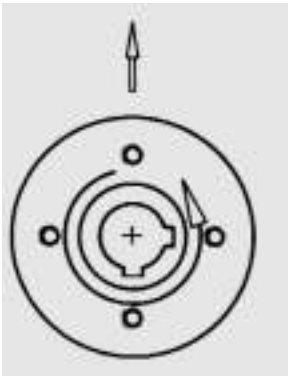

FIELD WIRING
ACTUATOR WIRING
TB
+t°
Heater
(Opt.)
L2
(Neutral)
A.C. Line
L1
M1
Thermal Overload
Automatic Reset
Bridge
Rectifier
Motor's
Brake
M2
M3
Capacitor
CCW
Stop
CW
COM
NO
NC
Switch 2
Switch 1
Switch 3
Switch 4
SP-3 Position
Snap Action
Switch
Green Ground Screw

○

○

○






TYPE
SR


4.56 MAX

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

Section VIII

Damper Limit Switch Maintenance and Operation Information

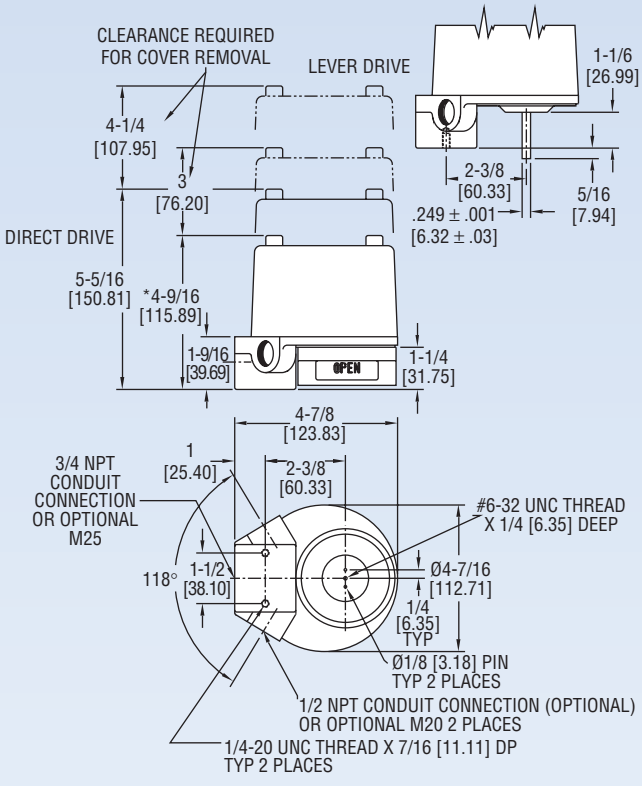
PROXIMITY®

Mark 4

Rotary Position Indicator

Thru-Shaft Switches and Transmitters
Explosion Proof and General Purpose

Cutaway View Model 42RD0J2 Shown



*FOR MODELS 11, 12, 41, 42, 61 & 62

BENEFITS

- A shaft through a 1″ bushing and O-ring seals the switch compartment for hazard, corrosion and leak protection, (IP 68 submersible).
- Set screw cams provide infinite adjustment, and user-friendly manual cams provide single-step rotational adjustment and locking set screw.
- Flexible design allows multiple mechanical or proximity switch and transmitter option(s).
- Adjustable stainless steel visual indicator with scale is standard for quarter turn direct drive applications.
- Housing options include 1, 2 or 3 conduit entrances, junction package, terminal strip and solenoid valve(s).
- Mounting hardware available in plated or stainless steel for your specific requirements includes rotary, linear and Namur mounting hardware.
- High temperature to 600°F for limited duration consult factory for available options.

APPLICATIONS

- Rotary valve actuators and dampers
- Linear valve actuators and cylinders
- Manual valves
- Gear operators
- Positioners

SPECIFICATIONS

Minimum Rotational Travel: 5°.

Maximum Rotational Travel: 360°.

Operational Life: 1,000,000 cycles.

Operating Temperature: -65 to 180°F (-54 to 82°C).

Weight: 3 lb (1.5 k) to 6 lb (3.0 k).

Maximum Altitude: 2000 m (6560 ft).

(Consult Factory for Pneumatic Indicator Data)

See page 4 for other specifications.

Suggested Specification

Position indicators shall be Proximity Model 4XXXXXX. The indicator(transmitter)(potentiometer) shall include 0(1)(2) (4)(6) switch(es). The switch(es) shall be SPDT (DPDT) (Namur)(Magnetic Blow-out) mechanical (proximity) rated at _____ amps. The coupling shall be direct(lever) drive. The housing shall be painted aluminum (epoxy coated) with a screw-on metal(clear plastic) cover. The housing shall include one 3/4″ NPT conduit entrance and 0(1)(2) 1/2″ NPT conduit entrance(s) (and terminal strip). It shall be NEMA 4,4X,7,9, UL/CSA certified Class I Groups C, D Divisions 1 and 2 (ATEX Flameproof) (ATEX Intrinsically Safe - IS) (SAA Flameproof). See reverse side for complete specifications and ordering information. The part number is 4XXXXXX.

Specifications and Ordering Information

4	Mark 4, Thru-Shaft

FUNCTION DATA

1	1 Switch*
2	2 Switches*
3	Potentiometer, 1K Ohm. Available with Switch Types B, C, I, O, R, S, V, W*†
32	Potentiometer, 2K Ohm. Available with Switch Types B, C, I, O, R, S, V, W*†
35	Potentiometer, 5K Ohm. Available with Switch Types B, C, I, O, R, S, V, W*†
310	Potentiometer, 10K Ohm. Available with Switch Types B, C, I, O, R, S, V, W*†
320	Potentiometer, 20K Ohm. Available with Switch Types B, C, I, O, R, S, V, W*†
4	4 Switches*
5	Transmitter, 4 to 20 mA. Available with Switch Types B, C, I , O, R, S, V, W*†
6	6 Switches. Available with Switch Types B, C, I, R, V, W
7	AS-interface and 1 Switch. Available with Switch Types B, I, R, W*
8	AS-interface and 2 Switches. Available with Switch Types B, I, R, W*

SWITCH DATA

O	No Switches*
A	SPDT Snap, Rated: 15A @ 125/250/480 VAC (~): 1/8 hp @ 125 VAC (~), 1/4 hp @ 250 VAC (~). 1/2A @ 125 VDC (⎓), 1/4A @ 250 VDC (⎓).
B	Inductive sensor. 10 to 30 VDC (⎓) Load: 0.1A*
C	SPDT High Temperature Snap, 350°F (176°C) for 600 hours. Rated:, 15.1A @ 125/250/277 vac (~).*
D	DPDT Snap, Rated: 10A @ 125/250 VAC (~) 0.3A @ 125 VDC (⎓), 0.15A @ 250 VDC (⎓).
G	SPDT Gold Contact Snap, Rated: 1A @ 125 VAC (~).
H	SPDT Hermetically Sealed Snap. Rated: 1A @ 125 VAC (~).
I	NAMUR Inductive Sensor. 15 mA max @ 5-25 VDC (⎓).*
M	SPDT Magnetic Blow Out, Rated: 10A @ 125 VAC (~)/VDC (⎓), 1/4 hp @ 125 VAC (~)/VDC (⎓).
R	SPDT Hermetically Sealed Reed, Rated: 2A @ 125 VAC (~), 2A @ 24 VDC (⎓).*
S	SPDT Snap, Rated: 4A @ 125/250 VAC (~).
T	SPDT High Temperature Snap, 250°F (121°C) Continuous, Rated: 5A @ 125/250/480 VAC (~).
V	SPDT Snap, Rated: 11A @ 125/250 VAC (~), 1/3 hp @ 125/250 VAC (~), 1/2 A @ 125 VDC (⎓). 1/4A @ 250 VDC (⎓), 4A @ 125 VAC (~) (tungsten)*
W	SPDT Gold Contract Snap, Rated: 0.1A @ 125 VAC (~)*

4xTxx switch has been successfully tested to 250° C for one hour to meet NFPA-130 and NFPA-502 requirements.

DRIVING METHOD

D	Direct Drive, Stainless Steel Visual Indicator Standard*
L	Lever Drive, Shaft Output*

HOUSING MATERIAL AND FINISH

0	Aluminum, Painted Black.* (Other colors available, consult factory)
1	Aluminum, Painted White Epoxy with SS trim.*
6	Cast 316 Stainless Steel*

SPECIAL ENCLOSURE FEATURES

J1	Junction Package with One 1/2˝ Female NPT Conduit Connection and Terminal Strip.*
J2	Junction Package with Two 1/2˝ Female NPT Conduit Connection and Terminal Strip.*
S	SAA Listed Flameproof*
SV1	1 Attached Solenoid Valve (Must be ordered with J1 option)*
SV2	2 Attached Solenoid Valve (Must be ordered with J2 option)*
MT	Metric Threaded Conduit Connection, M25 (M20 for optional J1 and J2 connections).*
B	Directive 94/9/EC, KEMA 03 ATEX 2391, CE Ex II 2 G EEx d IIC T6 (-20°C≤ Tamb ≤70°C) (T5 (-20°C≤Tamb≤80°C) optional wording).*
IS	Directive 94/9/EC, KEMA 03 ATEX 1392 X CE Ex II 1 G EEx Ia IIC T4 (-20°C≤ Tamb ≤40°C)

4	2	A	D	0	EXAMPLE OF POPULAR MODEL NUMBER

† Potentiometer and transmitter outputs will have no switches when ordered with switch type O, 2 switches if ordered with switch types B, C, I, R, V, or W, and 4 switches if ordered with switch type S. No other switch types are available.

*Junction package available. Consult factory for solenoid valve packages and pneumatic indicator option.

NOT COMPATIBLE WITH "T" (HIGH TEMP SWITCH)

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

NOTE: When ordering mounting kits, please supply make and model number of your actuator or valve.

UL Class I, Groups C,D, Class II, Groups E,F,G, Divisions 1 and 2

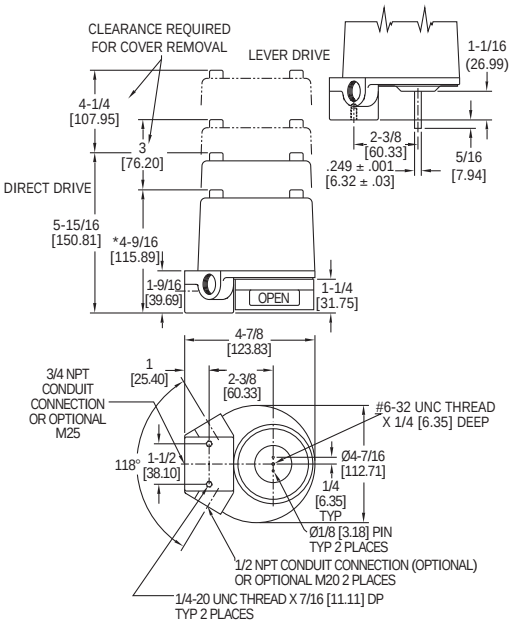
CSA Class I, Groups C,D, Class II, Groups E,F,G, Divisions 1 and 2

NEMA Designed to meet type 1,2,3,3R,3S,4,4X,6,7,9,12,13

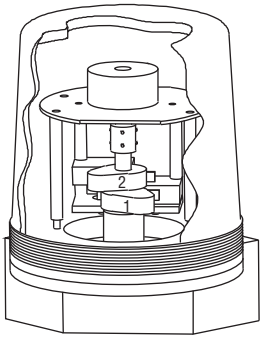
Ex II 2 G EEx d IIC T6 or T5(Flameproof – B; Special Enclosure Features)
II 1 G EEx ia IIC T4 (Intrinsically Safe – IS; Special Enclosure Features)
Ingress Protection Certified IP68

Certified Ex d IIC T6 IP68 (15 meters)

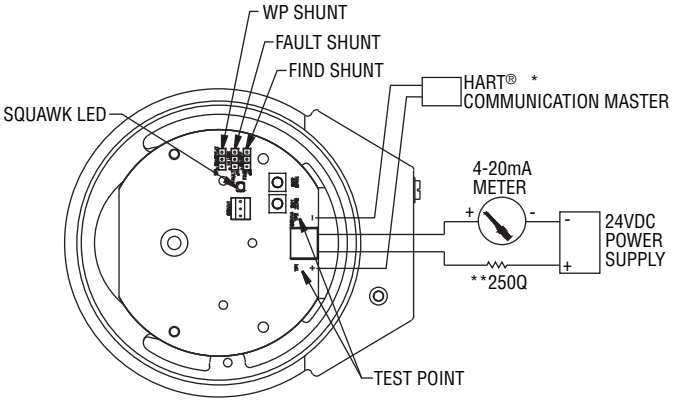

PROXIMITY

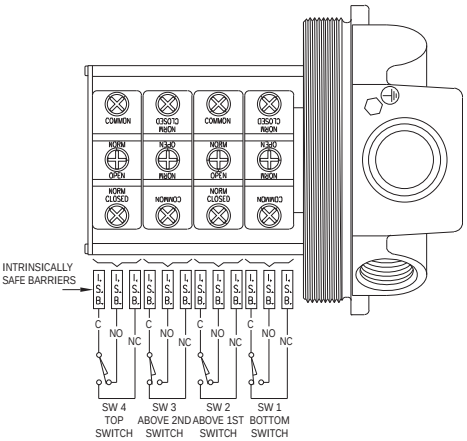


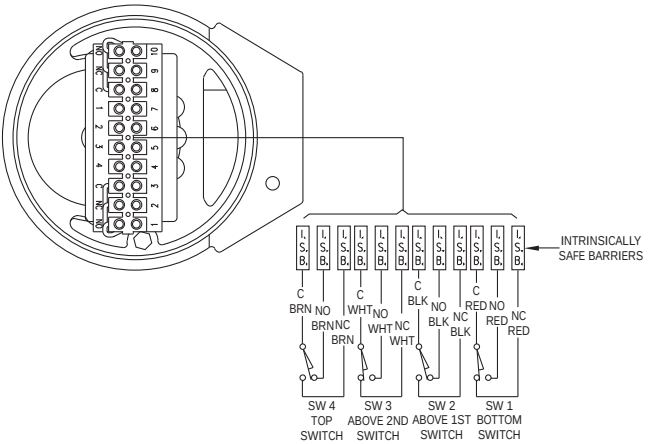
*FOR MODELS 11, 12, 41 & 42

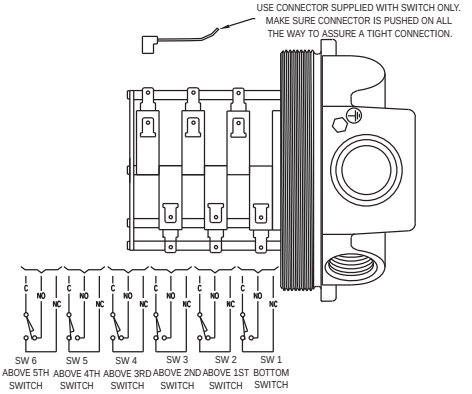

2
1

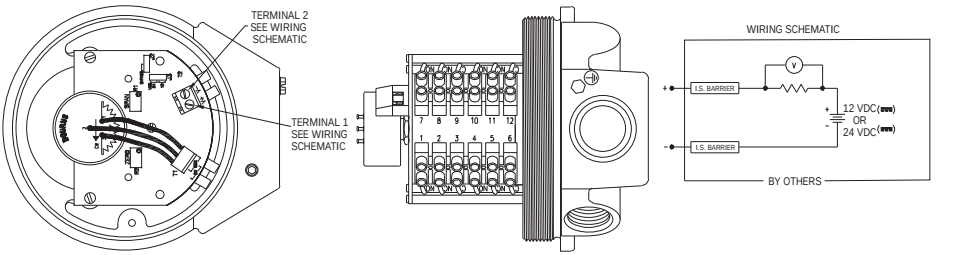
* OPTIONAL, MAYBE CONNECTED TO TEST POINT AS SHOWN OR TO SCREW TERMINALS
** REQUIRED FOR HART® COMMUNICATIONS, OPTIONAL OTHERWISE

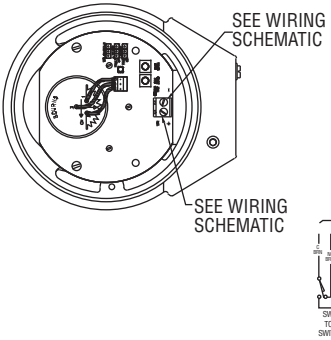


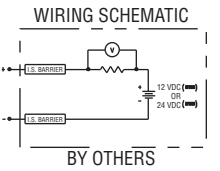

COMMON
NORM CLOSED
NORM OPEN
COMMON
NORM CLOSED
NORM OPEN
COMMON
NORM CLOSED
NORM OPEN
COMMON
NORM CLOSED
NORM OPEN
INTRINSICALLY SAFE BARRIERS
I.S.B.
C
NO
NC
SW 4 TOP SWITCH
SW 3 ABOVE 2ND SWITCH
SW 2 ABOVE 1ST SWITCH
SW 1 BOTTOM SWITCH


INTRINSICALLY
SAFE BARRIERS
C
BRN
NO
BRN
NC
BRN
C
WHT
NO
WHT
NC
WHT
C
BLK
NO
BLK
NC
BLK
C
RED
NO
RED
NC
RED
SW 4
TOP
SWITCH
SW 3
ABOVE 2ND
SWITCH
SW 2
ABOVE 1ST
SWITCH
SW 1
BOTTOM
SWITCH


USE CONNECTOR SUPPLIED WITH SWITCH ONLY.
MAKE SURE CONNECTOR IS PUSHED ON ALL
THE WAY TO ASSURE A TIGHT CONNECTION.
C
NO
NC
SW 6
ABOVE 5TH
SWITCH
SW 5
ABOVE 4TH
SWITCH
SW 4
ABOVE 3RD
SWITCH
SW 3
ABOVE 2ND
SWITCH
SW 2
ABOVE 1ST
SWITCH
SW 1
BOTTOM
SWITCH


TERMINAL 2
SEE WIRING
SCHEMATIC
TERMINAL 1
SEE WIRING
SCHEMATIC
7
8
9
10
11
12
1
2
3
4
5
6
WIRING SCHEMATIC
I.S. BARRIER
I.S. BARRIER
V
12 VDC
OR
24 VDC
BY OTHERS


SEE WIRING
SCHEMATIC
SEE WIRING
SCHEMATIC
SW 4
TOP
SWITCH
SW 3
ABOVE 2nd
SWITCH
SW 2
ABOVE 1st
SWITCH
SW 1
BOTTOM
SWITCH


WIRING SCHEMATIC
I.S. BARRIER
I.S. BARRIER
12 VDC
OR
24 VDC
BY OTHERS

PROXIMITY

GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

Phone: 715.359.6171
www.greenheck.com

Section IX

Damper Wiring Data

Product Data Sheet

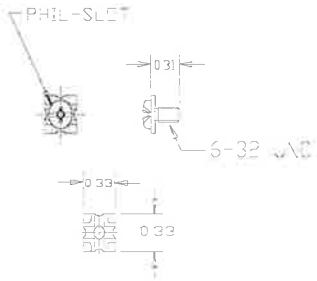
MARATHON® SPECIAL PRODUCTS
A REGAL-BELOIT Company

(6 Pole shown)

2XX Series SP

Replace "XX" with 01 through 30 for number of poles

Terminal Block– Closed Back
With Sems Pressure Saddle Screw
20 Amps, 250 Volts (AC/DC)



Copper Stranded Wire only.

Wire Range with Wire Binding Screw: #12 - #22 AWG

7/16" Centers

Application torque: 12 in. lbs

Electrical Ratings:
- 20A with Listed ring lug or unprepared wire, (Based on NEC Table 310-16, 75°C columns)
- 250 Volts AC/DC (UL 1059 Class B, User Group – Commercial Appliances)
- Short Circuit Current Rating: 10,000A (Default)
- Approved for Factory and Field Wiring.

Mechanical Ratings:
- Storage and transportation temperature range: -35°C to 110°C (-31°F to 230°F)*
- Maximum insulator base temperature: 150°C (302°F)* UL RTI
- Flammability rating of insulator base: UL 94V-1

* Use outside these ratings needs to be judged in the end-use application.

Materials:
- Connector (Contact): Brass, tin plated.
- Insulator base: Phenolic
- Drive screw (Rivet): Stainless steel
- Screw, #6-32 Saddle Plate, Phil-Slot: Steel, nickel plated

Agency Approvals:
- UL Recognized, UL 1059 Terminal Block Standard, File No. XCFR2.E62806
- CSA Certified, CSA C22.2 No. 158, File No. LR19766
- CE compliant, IEC 60947-7-1
- RoHS Compliant

Wire Range:

		Copper Wire Stranding Classes - Number of Strands		
Wire Size	Torque	Solid	Class B	Class C
12	12 in. Lbs		7	19
14	12 in. Lbs		7	19
16	12 in. Lbs		7	19
18	12 in. Lbs		7	19
20	12 in. Lbs		7	19
22	12 in. Lbs		7	19

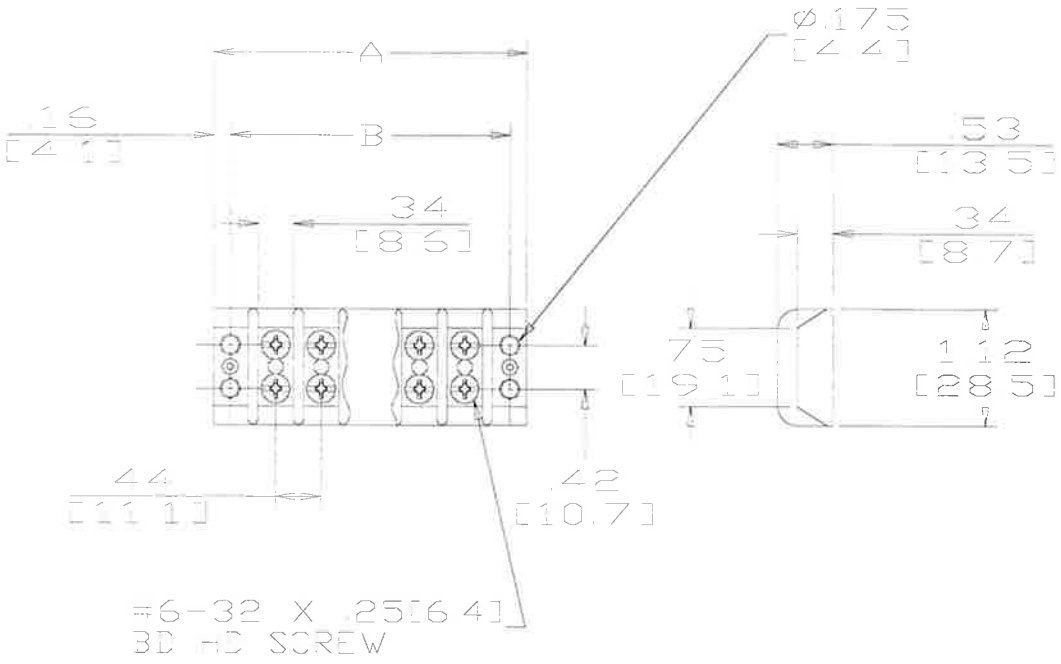
Suggested product mounting hardware: #6 fastener, torque to 10-15 in. lbs.

ACCESSORIES:
- Printing (for printing options, see Terminal Block Printing on website)

- Marking strips - sub mounted, black only (FB) (For Printing Options, see section on website)

- Marking strips – top mounted, white only (SW)

- Cover – top mounted. Order CW (white) or CB (Black). Can be printed. See website.



		Dimensions					Dimensions	
Catalog No	# of Poles	A	B		Catalog No	# of Poles	A	B
201	1	1.19	0.88	X	216	16	7.75	7.44
202	2	1.62	1.31	X	217	17	8.19	7.88
203	3	2.06	1.75	X	218	18	8.62	8.31
204	4	2.50	2.19	X	219	19	9.06	8.75
205	5	2.94	2.63	X	220	20	9.50	9.19
206	6	3.37	3.06	X	221	21	9.93	9.62
207	7	3.81	3.50	X	222	22	10.37	10.06
208	8	4.25	3.94	X	223	23	10.81	10.50
209	9	4.68	4.37	X	224	24	11.24	10.93
210	10	5.12	4.81	X	225	25	11.68	11.37
211	11	5.56	5.25	X	226	26	12.12	11.81
212	12	5.99	5.68	X	227	27	12.55	12.24
213	13	6.43	6.12	X	228	28	12.99	12.68
214	14	6.87	6.56	X	229	29	13.43	13.12
215	15	7.31	7.00	X	230	30	13.86	13.55

MM = Dim X 25.4

WWW.MARATHONSP.COM
1-419-352-8441

PDS 0244 REV A 2/21/08

TYPE - ATX

Contact your local Sales Representative
Click Here for Printable Version

Trade Size	Type	Inside Bend Radius	WT. (Lbs.)/ 100 Ft.	Carton Length	Carton Part #	Reel Length	Reel Part #	Reel Length	Reel Part #	List Price Price Per 100 FT
3/8"	ATX-10	1.5"	21	100	60201	500	60203	1000	60204	$456.00
1/2"	ATX-11	2.0"	27	100	61201	500	61203	1000	61204	$524.00
3/4"	ATX-12	2.5"	39	100	62202	500	62204	1000	62210	$674.00
1"	ATX-13	3.0"	56	100	63202	400	63204	-	-	$1,077.80
1-1/4"	ATX-14	3.5"	73	50	64202	200	64204	-	-	$1,394.00
1-1/2"	ATX-15	4.5"	104	50	65202	150	65204	-	-	$1,973.00
2"	ATX-16	5.5"	136	50	66202	100	66204	-	-	$2,465.00
2-1/2"	ATX-17	8.0"	188	25	67202	-	-	-	-	$5,173.00
3"	ATX-18	10.0"	210	25	68202	-	-	-	-	$7,155.00
4"	ATX-19	12.0"	332	25	69202	-	-	-	-	$11,267.00

See Chart for Dimensions and Tolerances.

TYPE - ATX
A conduit designed to withstand an extreme temperature range

CONSTRUCTION:
Utilizes the flexibility of our standard LT core, coupled with the advantage of a Thermoplastic Rubber jacket that is virtually unaffected by temperature extremes and that contains no halogens. The material has a flammability rating of UL 94-HB and is UV stabilized

APPLICATION:
Used in situations where concerns of resistance to temperature exposure exist. These include heavy outdoor equipment, boilers, furnaces and sub-zero areas.

Tests Include:
WEEE and RoHS Compliant

STANDARD COLORS:
Black

WORKING TEMPERATURES:
-60°C to 150°C Intermitting to 165°C
For applications at the maximum rated working temperature of 150°C, Electri-Flex recommends the use of Thomas&Betts® 5300HT series of liquidtight connectors. The gland ring and insulated throat in these fittings are rated for 150°C.

Flexibility: See the Flexibility Comparison Guide

Metal Used: Steel

Plastic Used: TPR See the Type ATX - Chemical Resistance Guide

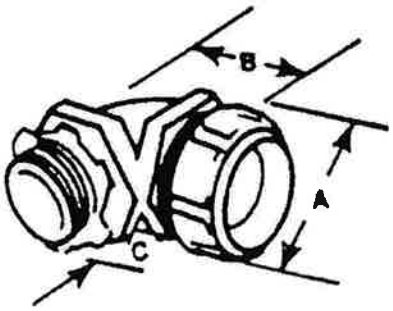
High Mech. Strength	Listed For Direct Burial	Halogen Free	Low Fire Hazard	Accepts Standard Liquidtight Fittings	Self Extinquish	EMI/RFI Shielding	Oil Resistance	Acid Resistance
		X		X			X	

® Electri-Flex Company 1-800-323-6174

T&B® Fittings

T&B Catalog Number: 5253
UPC Number: 78621005253
Description: 3/4" 90° malleable iron liquidtight connector

Status: Active



Features	
-	Ability to install quickly with low torque effort
Application	
-	Used where flexible metal raceway is installed in outdoor or indoor locations where exposed to continuous or intermittent moisture.
-	To positively bond conduit to box or enclosure.
General	
-Material	Malleable Iron
-Finish	Electro Zinc Plated with Chromate Coating
-Conduit Size (inches)	3/4
Dimension Information	
-Dimension A (inches)	1 21/32
-Dimension B (inches)	1 3/4
-Dimension C (inches)	9/16
Specifications	
-3dmodel	Available on Website
Accessories & Components	
-Wiremesh Grips for Liquidtight Fittings	WMG-LT3
Packaging	
-T&B Inner Pack	10
-Package in Units	50
-T&B Sold in UOM	Each
-T&B Weight Per UOM	39.6 lbs. per 100
Application Support	
-Product Overview	Available on Website
Certifications	
-RoHS Compliance	Yes
Certifications	

File Nbr:
E 23018

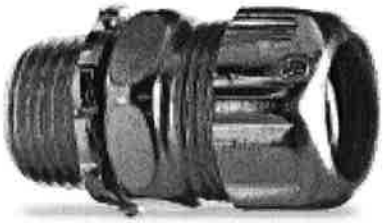
For further technical assistance, please contact us...

Thomas & Betts - USA
8155 T&B Blvd.
Memphis, TN 38125
www.tnb.com

T&B Technical Support
MS 3B-50
8155 T&B Blvd.
Memphis, TN 38125

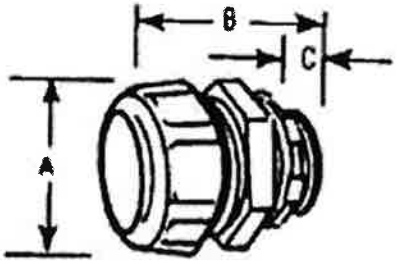
Hours: 7AM - 6PM CDT
Monday-Friday
Phone: (888) 862-3289
Fax: (901) 252-1321
Email:techsupport@tnb.com

T&B® Fittings



T&B Catalog Number: 5233
UPC Number: 78621005233
Description: 3/4" Straight steel liquidtight connector

Status: Active



Features	
-	Ability to install quickly with low torque effort
Application	
-	Used where flexible metal raceway is installed in outdoor or indoor locations where exposed to continuous or intermittent moisture.
-	To positively bond conduit to box or enclosure.
General	
-Material	Steel
-Finish	Electro Zinc Plated with Chromate Coating
-Conduit Size (inches)	39876
Dimension Information	
-Dimension A (inches)	1 21/32
-Dimension B (inches)	1 5/8
-Dimension C (inches)	9/16
Specifications	
-3dmodel	Available on Website
Accessories & Components	
-Wiremesh Grips for Liquidtight Fittings	WMG-LT3
Packaging	
-T&B Inner Pack	25
-Package in Units	50
-T&B Sold in UOM	Each
-T&B Weight Per UOM	24.4 lbs. per 100
Application Support	
-Product Overview	Available on Website
Certifications	
-RoHS Compliance	Yes
Certifications	

File Nbr:
E 23018

For further technical assistance, please contact us...

Thomas & Betts - USA
8155 T&B Blvd.
Memphis, TN 38125
www.tnb.com

T&B Technical Support
MS 3B-50
8155 T&B Blvd.
Memphis, TN 38125

Hours: 7AM - 6PM CDT
Monday-Friday
Phone: (888) 862-3289
Fax: (901) 252-1321
Email:techsupport@tnb.com

CONTINUOUS-HINGE WITH CLAMPS, TYPE 4X

INDUSTRY STANDARDS

UL 50, 50E Listed; Type 3R, 4, 4X, 12; File No. E27567
cUL Listed per CSA C22.2 No 94; Type 3R, 4, 4X, 12; File No. E27567
UL 508A Listed; Type 3R, 4, 4X, 12; File No. E61997
cUL Listed per CSA C22.2 No 94; Type 3R, 4, 4X, 12; File No. E61997

NEMA/EEMAC Type 3R, 4, 4X, 12, 13
CSA File No. 42184: Type 4, 4X, 12
IEC 60529, IP66
Meets NEMA Type 3RX requirements

APPLICATION

Used in either indoor or outdoor applications, these enclosures combine a rugged continuous hinge, seamless foam-in-place gasket and stainless steel screw-down clamps for a reliable seal that protects components from corrosive environments.

SPECIFICATIONS

- 16 and 14 gauge ~~Type 304 or~~ 316L stainless steel
- Seams continuously welded and ground smooth
- ~~Seamless foam-in-place gasket~~ MODIFIED FOR ATEX SILICONE GASKET
- Stainless steel screws and clamps
- Pull stainless steel continuous hinge pin to remove door
- Weldnuts provided for mounting optional panels and terminal block kits
- Bonding provision on door and body

FINISH

Cover and sides of body have smooth #4 brushed finish.

ACCESSORIES

See also Accessories.
Fast-Operating Clamp-Cover Junction Box Clamp
Lock Kit for Clamp Cover Junction Boxes
Panels for Junction Boxes
Terminal Block Kit Assembly for Junction Boxes Overview

MODIFICATION AND CUSTOMIZATION

Hoffman excels at modifying and customizing products to your specifications. Contact your local Hoffman sales office or distributor for complete information.

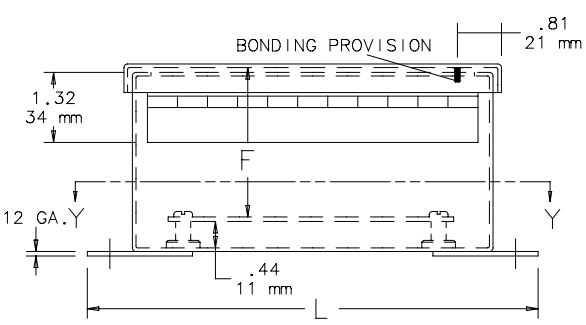
BULLETIN: A51S

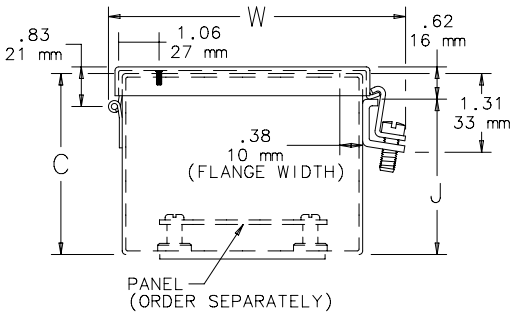
Standard Product

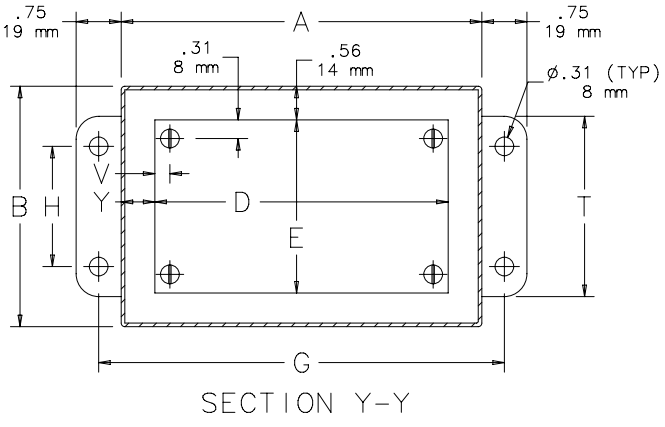
Catalog Number	AxBxC in./mm	Stainless Steel Type	UL Listed	Body Gauge	Cover Gauge	Steel Panel	Conductive Panel	Panel Size D x E in./mm	Mounting G x H in./mm	Overall L x W in./mm	F in./mm	J in./mm	N in./mm	T in./mm	V in./mm	Y in./mm
~~A6044CHNFSS~~	6.00 x 4.00 x 4.00 152 x 102 x 102	304	508A	16	16	A6P4	A6P4G	4.88 x 2.88 124 x 73	6.75 x 2.00 171 x 51	7.50 x 4.94 191 x 125	3.50 89	3.62 92	2.38 60	3.00 76	0.31 8	0.56 14
~~A606CHNFSS~~	6.00 x 6.00 x 4.00 152 x 152 x 102	304	50, 50E	16	16	A6P6	A6P6G	4.88 x 4.88 124 x 124	6.75 x 4.00 171 x 102	7.50 x 6.94 191 x 176	3.50 89	3.62 92	2.38 60	5.00 127	0.31 8	0.56 14
~~A8064CHNFSS~~	8.00 x 6.00 x 4.00 203 x 152 x 102	304	50, 50E	14	16	A8P6	A8P6G	6.75 x 4.88 171 x 124	8.75 x 4.00 222 x 102	9.50 x 6.94 241 x 176	3.50 89	3.62 92	1.38 35	5.00 127	0.25 6	0.62 16
~~A1008CHNFSS~~	10.00 x 8.00 x 4.00 254 x 203 x 102	304	50, 50E	14	16	A10P8	A10P8G	8.75 x 6.88 222 x 175	10.75 x 6.00 273 x 152	11.50 x 8.94 292 x 227	3.50 89	3.62 92	1.38 35	7.00 178	0.25 6	0.62 16
~~A12106CHNFSS~~	12.00 x 10.00 x 6.00 305 x 254 x 152	304	50, 50E	14	16	A12P10	A12P10G	10.75 x 8.88 273 x 225	12.75 x 8.00 324 x 203	13.50 x 10.94 343 x 278	5.50 140	5.62 143	2.38 60	9.00 229	0.25 6	0.62 16
~~A1212CHNFSS~~	12.00 x 12.00 x 6.00 305 x 305 x 152	304	50, 50E	14	16	A12P12	A12P12G	10.75 x 10.88 273 x 276	12.75 x 10.00 324 x 254	13.50 x 12.94 343 x 329	5.50 140	5.62 143	2.38 60	11.00 279	0.25 6	0.62 16
~~A1412CHNFSS~~	14.00 x 12.00 x 6.00 356 x 305 x 152	304	50, 50E	14	16	A14P12	A14P12G	12.75 x 10.88 324 x 276	14.75 x 10.00 375 x 254	15.50 x 12.94 394 x 329	5.50 140	5.62 143	2.38 60	11.00 279	0.25 6	0.62 16
~~A1614CHNFSS~~	16.00 x 14.00 x 6.00 406 x 356 x 152	304	508A	14	16	A16P14	A16P14G	14.75 x 12.88 375 x 327	16.75 x 12.00 425 x 305	17.50 x 14.94 445 x 379	5.50 140	5.62 143	2.38 60	13.00 330	0.25 6	0.62 16
A6044CHNFSS6	6.00 x 4.00 x 4.00 152 x 102 x 102	316L	50, 50E	16	16	A6P4	A6P4G	4.88 x 2.88 124 x 73	6.75 x 2.00 171 x 51	7.50 x 4.94 191 x 125	3.50 89	3.62 92	2.38 60	3.00 76	0.31 8	0.56 14
A606CHNFSS6	6.00 x 6.00 x 4.00 152 x 152 x 102	316L	50, 50E	16	16	A6P6	A6P6G	4.88 x 4.88 124 x 124	6.75 x 4.00 171 x 102	7.50 x 6.94 191 x 176	3.50 89	3.62 92	2.38 60	5.00 127	0.31 8	0.56 14
A8064CHNFSS6	8.00 x 6.00 x 4.00 203 x 152 x 102	316L	50, 50E	14	16	A8P6	A8P6G	6.75 x 4.88 171 x 124	8.75 x 4.00 222 x 102	9.50 x 6.94 241 x 176	3.50 89	3.62 92	1.38 35	5.00 127	0.25 6	0.62 16
A1008CHNFSS6	10.00 x 8.00 x 4.00 254 x 203 x 102	316L	50, 50E	14	16	A10P8	A10P8G	8.75 x 6.88 222 x 175	10.75 x 6.00 273 x 152	11.50 x 8.94 292 x 227	3.50 89	3.62 92	1.38 35	7.00 178	0.25 6	0.62 16
A12106CHNFSS6	12.00 x 10.00 x 6.00 305 x 254 x 152	316L	50, 50E	14	16	A12P10	A12P10G	10.75 x 8.88 273 x 225	12.75 x 8.00 324 x 203	13.50 x 10.94 343 x 278	5.50 140	5.62 143	2.38 60	9.00 229	0.25 6	0.62 16
A1212CHNFSS6	12.00 x 12.00 x 6.00 305 x 305 x 152	316L	50, 50E	14	16	A12P12	A12P12G	10.75 x 10.88 273 x 276	12.75 x 10.00 324 x 254	13.50 x 12.94 343 x 329	5.50 140	5.62 143	2.38 60	11.00 279	0.25 6	0.62 16
A1412CHNFSS6	14.00 x 12.00 x 6.00 356 x 305 x 152	316L	50, 50E	14	16	A14P12	A14P12G	12.75 x 10.88 324 x 276	14.75 x 10.00 375 x 254	15.50 x 12.94 394 x 329	5.50 140	5.62 143	2.38 60	11.00 279	0.25 6	0.62 16
A1614CHNFSS6	16.00 x 14.00 x 6.00 406 x 356 x 152	316L	50, 50E	14	16	A16P14	A16P14G	14.75 x 12.88 375 x 327	16.75 x 12.00 425 x 305	17.50 x 14.94 445 x 379	5.50 140	5.62 143	2.38 60	13.00 330	0.25 6	0.62 16

A6044CHNFSS and A6044CHNFSS6 UL 508A Listed. The remaining catalog numbers are UL 50 Listed.

Purchase panels separately. Optional stainless steel, composite and aluminum panels are available for most sizes.

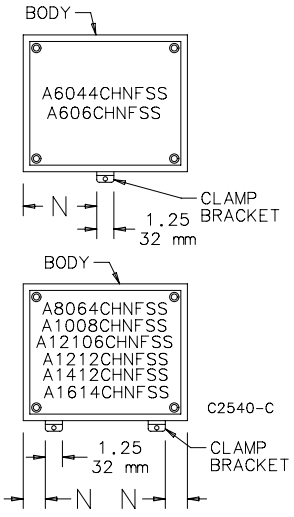






NOTE:
1. Optional panels are 14 gauge steel, conductive steel or stainless steel
2. Panel screws are #10-32 pan head

CLAMP BRACKET LOCATIONS



Thermal Wire and Cable Corp.
White Lake Corporate Park
`527 Plover Avenue
.aples, FL 34117-8408
Telephone :239-430-WIRE (9473)
Fax : 239-435-1779
E-Mail :
Online :

250°C (482°F) SRML Silicone Rubber Motor Lead Wire 600V Single Conductor

Thermal Wire and Cable's Type SRML insulated cables offer a wide service temperature range of -65°C to + 250°C and are quite flexible in nature. Silicone rubber compounds have much greater resistance to high temperatures and are available and presently being used in applications of an extremely severe nature. Typical applications include wiring of motors, fixtures, appliances, etc.

Sil-V silicone rubber is very resistant to extremely low temperatures. The brittle point of the compound used is typically below -150°F. When heated beyond the maximum serviceable temperature rating or if burned, Sil-V silicone rubbers leaves a non-conductive silicone dioxide ash, which is an excellent dielectric that permits continued operation of the cable for an indefinite period, if left undisturbed. This flame resistance is greatly enhanced due to the cable being augmented with a treated overall glass braid. The cost per 1000 ft is less than Fluoropolymer insulated cables.

Sil-V insulated cables resistance to chemicals is excellent and a table is available to determine useful life in oils, bases, hydraulic fluids and solvents.

When modified silicone rubber is augmented with a colored braid, it is fire resistant, resistant to weathering, fungus, and has excellent electrical characteristics. Its flexible nature and small diameter profile provides for easy, economical installations. Fully pigmented jackets are available in any color. These cables are also available in multi-conductor flexible cables and 300 Volt rating for added cost advantages. Nickel-plated copper is standard conductor material. Pure nickel available upon request.

*Please specify color : 0-black, 1-brown (tan), 2-red, 3-orange, 4-yellow, 5-green, 6-blue, 7-purple, 8-gray, 9-white. For green base color with yellow stripe - 54.

Intended Use : UL Recognized 18-10 AWG as Internal Wiring of Appliances and Fixtures. CSA Certified as equipment wire.

**Based on single conductor in free air @ 40°C. Please consult article 310 of the national electrical code for further application and ampacity information.

Results 1 - 9 of 9

Item #	Wire Gauge	No. of Strands	Min. Nominal O.D.	Max. Nominal O.D.	Maximum Ampacity**
250-18SRML-*	18 AWG	16	0.120 inches	0.128 inches	23
250-16SRML-*	16 AWG	26	0.130 inches	0.138 inches	40
250-14SRML-*	14 AWG	41	0.145 inches	0.153 inches	59
250-12SRML-*	12 AWG	65	0.164 inches	0.172 inches	78
250-10SRML-*	10 AWG	105	0.217 inches	0.229 inches	107
250-8SRML-*	8 AWG	133	0.310 inches	0.320 inches	142
250-6SRML-*	6 AWG	133	0.350 inches	0.365 inches	205
250-4SRML-*	4 AWG	133	0.410 inches	0.425 inches	278
250-2SRML-*	2 AWG	133	0.480 inches	0.492 inches	381

Results 1 - 9 of 9

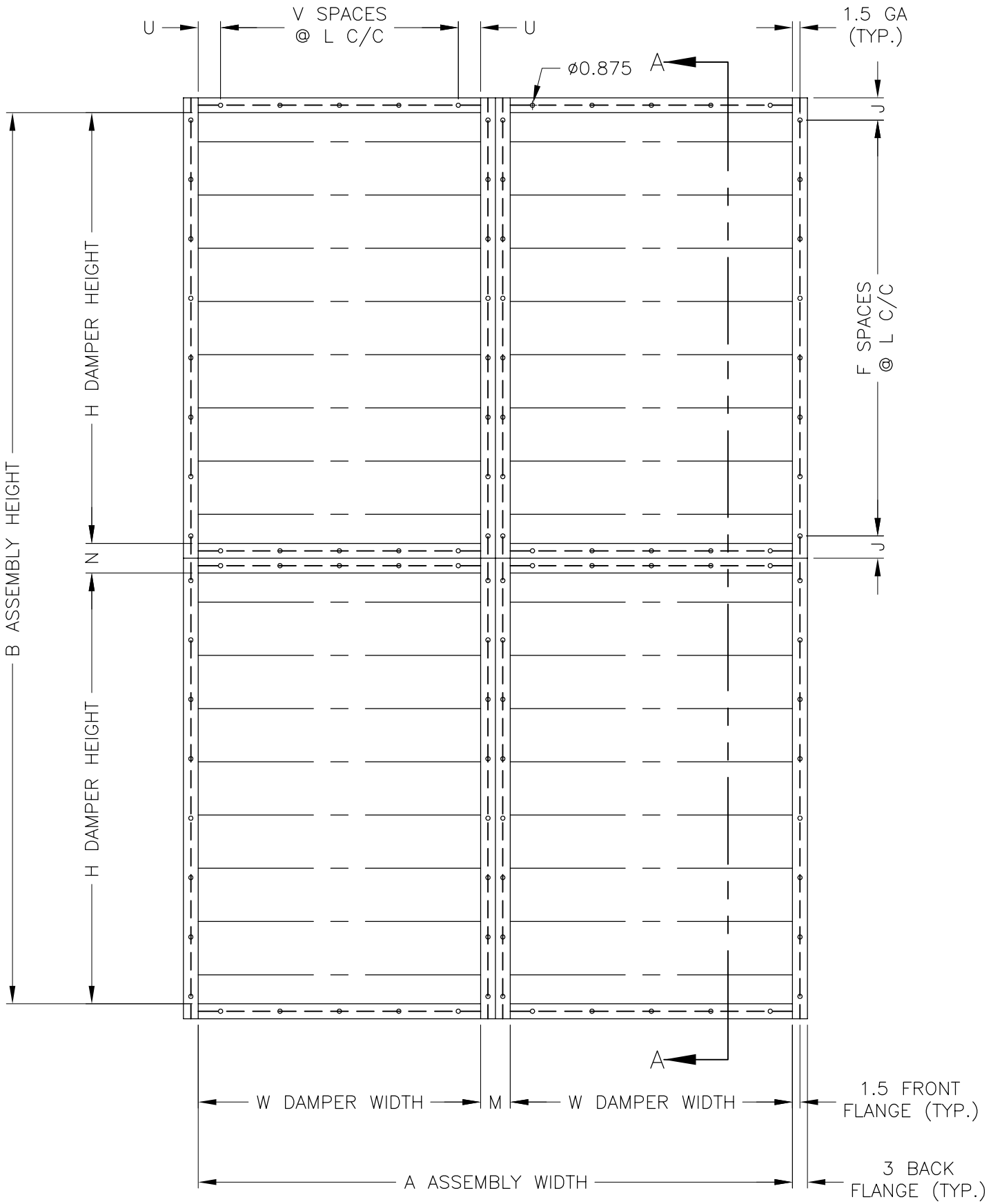
GREENHECK
Building Value in Air.

P.O. Box 410
Schofield, WI 54476

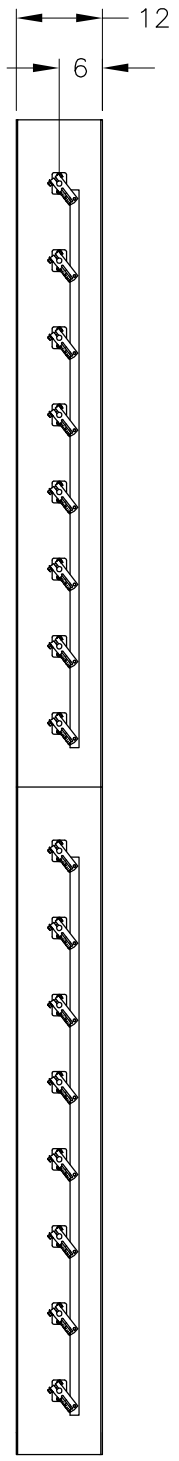
Phone: 715.359.6171
www.greenheck.com

Section X

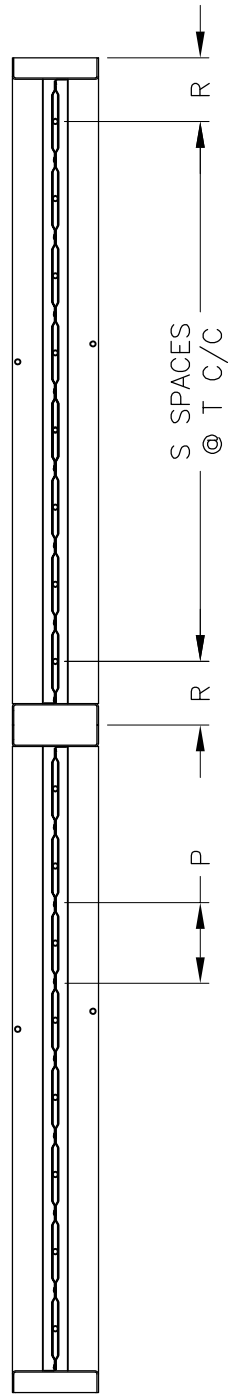
Approved Shop Drawings



FACE VIEW
AS VIEWED FROM THE BACK, DAMPER
MOUNTING SIDE (3" FLANGE)



END VIEW



SECTION A–A

REVISION	DCR	BY	DATE	SYM
UPDATED JUNCTION BOX		JLJ	03/10 2016	1

PROJECT INFORMATION

Job name: I-71 Lytle Tunnel Under Lytle Park
Bridge No. HAM-71-0314

PERFORMANCE

Model: HTD-630
Max. pressure: 12" w.g.
Max. temperature: 482°F for 1 hour (NFPA 502)
Max. velocity: 2,000 fpm

CONSTRUCTION

Frame: 12" x 3" x 1-1/2" channel, 3/16" thk, HRPO
seal-welded frame corners
Tie rods (for dampers > 60" H), CRS round bar
Ø1/2" for dampers ≤ 48" W, Ø3/4" for dampers > 48" W
Damper frame assembly finish is hot-dip galvanized
Mounting holes: As shown. Reference drawing T243-002 for values
Blades: Double-skin formed airfoil, 14 ga, galvanized
11-1/2" max width, blade action is parallel
bolted to axles with zinc-plated fasteners
Axles: Stub type, Ø3/4", 303 SS
Bearings: Stainless steel sleeve type, pressed into SS housing, exterior removable
Linkage: Clevis arms, 10 ga stainless steel
Tie bar, 1/4" x 1-1/4" stainless steel, w/oil impregnated
bronze bearings
Clevis pin, stainless steel
Cotter pin, stainless steel
Blade seal: Silicone
Jamb seal: Compression type, 316 SS
Finish: Mill, unless otherwise noted
Structural support: Structural carbon steel I-beam assembly
Finish is hot-dip galvanized
Actuator: RCS SURE with thermal blanket, 482°F for 1 hour
115VAC, 1 phase, 50/60Hz, NEMA 4, two position, spring return, fail-closed
4-SPDT switches, PTC heater, motor brake, manual override
SURE-49: 15 sec/90° power operation, 2 sec/90° spring operation
SURE-100: 10 sec/90° power operation, 5 sec/90° spring operation
Actuator sized for 150% of max. design torque at 2,000 fpm
and 14" w.g. damper operation
Reference drawing schedule T243-002 for actuator
sizing/quantity per damper
Limit switch: Proximity 44TL0
(4) SPDT switch elements,
capable of operation at 482° F (250° C) for one hour
Reference drawing schedule T243-002 for quantities
Electrical: Actuators and limit switches factory wired to junction boxes
using the following components:
Stainless steel junction box, 316SS w/ silicone gasket, NEMA Type 4X (1)
Marathon Special Products 2XX Series SP terminal block
Liquatite Type - ATX flexible metal conduit
Thermal Wire and Cable Corp. 250-14SRML wire
Thomas & Betts Series 52 conduit fittings
Gasket: Silicone, 50 Durometer Shore "A", 1/4" thk
provided in rolls with pre-punched holes on 12" centers
for use between 3" mounting flange and mating surface

☐ FOR RECORD ONLY
☐ APPROVED
☐ APPROVED AS NOTED
☐ REVISE AND RE-SUBMIT
BY: _____
DATE: _____

GREENHECK

TITLE
HTD-630 LYTLE
TUNNEL DAMPER
DRAWING

DRAWN BY: JRB	ECO: ----
DATE: 5/19/2015	ENG. REF.: ----
SUPERSEDES: ----	----
SCALE: 1/28	----
CAD DRAWING NO.: T243-001	B

REVISION	DCR	BY	DATE	SYM
CHANGED SIZE OF FI1~3 & TI-DS-1 & 6 UPDATED CELLS HIGHLIGHTED		JRB	6/22 2016	1

TAG NUMBER	QUANTITY	ASSEMBLY				STRUCTURAL SUPPORT		ACTUATOR		LIMIT SWITCH		PANEL					MOUNTING HOLES (PER DAMPER)					BLADE SPACING (PER DAMPER)			
		WIDTH (in)	HEIGHT (in)	BETWEEN DAMPERS WIDTH (in)	BETWEEN DAMPERS HEIGHT (in)	I-BEAM SIZE	QUANTITY (per asm)	MODEL	QUANTITY (per asm)	MODEL	QUANTITY (per asm)	QTY WIDE	QTY HIGH	WIDTH (in)	HEIGHT (in)	EST. WEIGHT per panel (lbs)	HEAD/SILL 1ST/LAST LOC (in)	JAMB 1ST/LAST LOC (in)	SPACING (in)	HORIZ SPACES (PER SIDE)	VERT SPACES (PER SIDE)	1ST/LAST BLADE LOC (in)	BLADES SPACES	BLADE SPACING (in)	BLADE WIDTH (in)
		A	B	M	N									W	H		U	J	L	V	F	R	S	T	P
FI1, 2, 3	4	144.00	180.00	24.00	6.00	W6 X 15	1	SURE49	4	44TL0	4	2	2	60.00	87.00	570	6.00	4.50	12.00	4	7	8.875	7.00	10.750	11.250
TI-DS-1	1	30.00	126.00	N/A	6.00	N/A	N/A	SURE49	1	44TL0	1	1	2	30.00	60.00	285	3.00	3.00	12.00	2	6	8.469	5.00	9.813	10.313
TI-DS-2, 3, 4, 5	4	60.00	120.00	N/A	6.00	N/A	N/A	SURE100	1	44TL0	1	1	2	60.00	69.00	489	6.00	1.50	12.00	4	6	9.219	5.00	11.313	11.813
TI-DS-6	1	60.00	126.00	N/A	6.00	N/A	N/A	SURE100	1	44TL0	1	1	2	60.00	60.00	430	6.00	3.00	12.00	4	6	8.469	5.00	9.813	10.313

☐ FOR RECORD ONLY
☐ APPROVED
☐ APPROVED AS NOTED
☐ REVISE AND RE-SUBMIT

BY: _____

DATE: _____

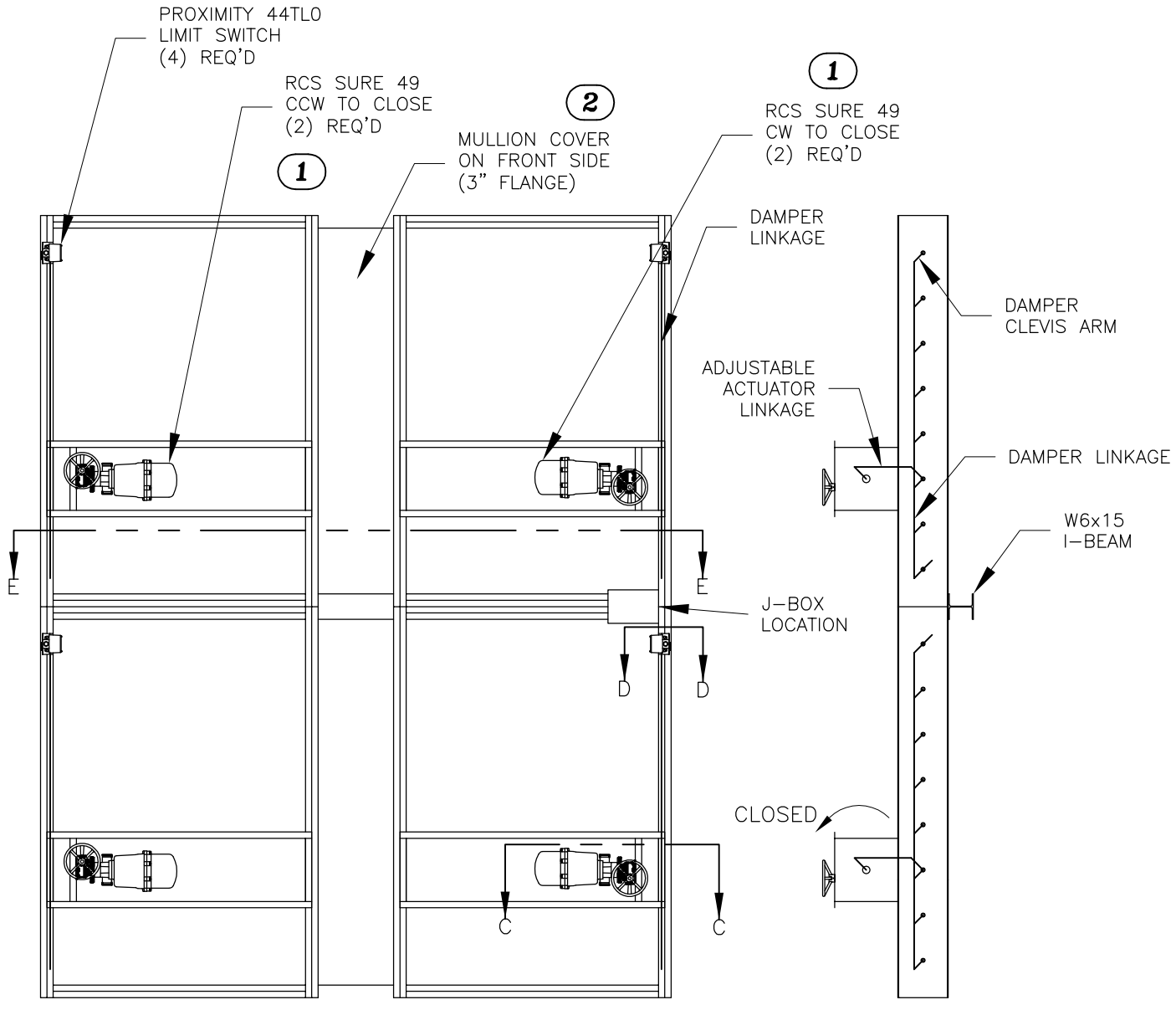
GREENHECK

TITLE

HTD-630 LYTLE
TUNNEL DAMPER
SCHEDULE

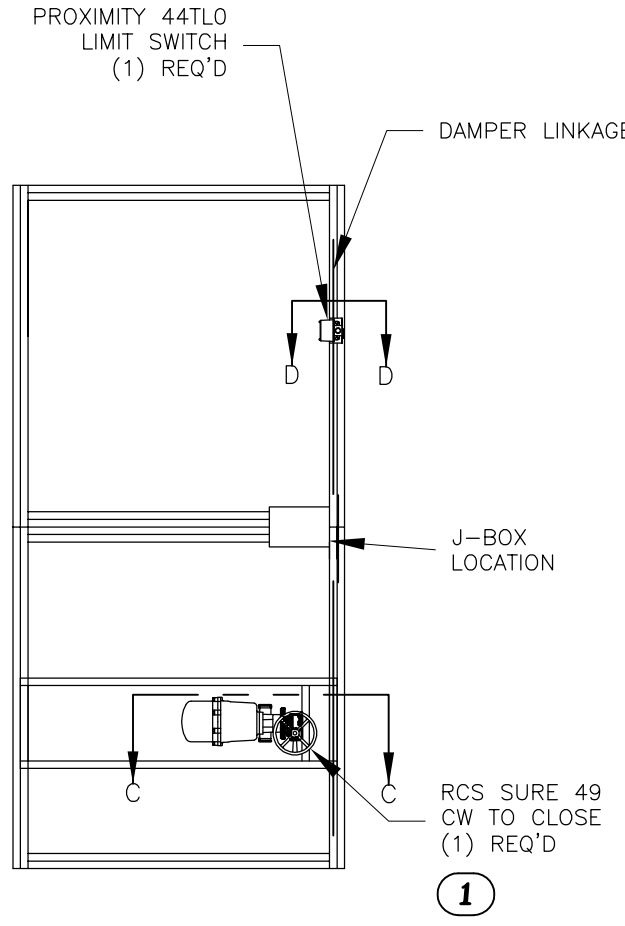
DRAWN BY: JRB	ECO: ----
DATE: 5/19/2015	ENG. REF.: ----
SUPERSEDES: ----	----
SCALE: 1/27	----
CAD DRAWING NO.: T243-002	---- B

REVISION	DCR	BY	DATE	SYM
ADDED ACTUATOR ROTATIONS; UPDATED LINKAGE ASSEMBLIES IN END VIEWS		JLJ	03/10 2016	1
WIDER VRT MULLION ON FI1~3		JRB	06/21 2016	2

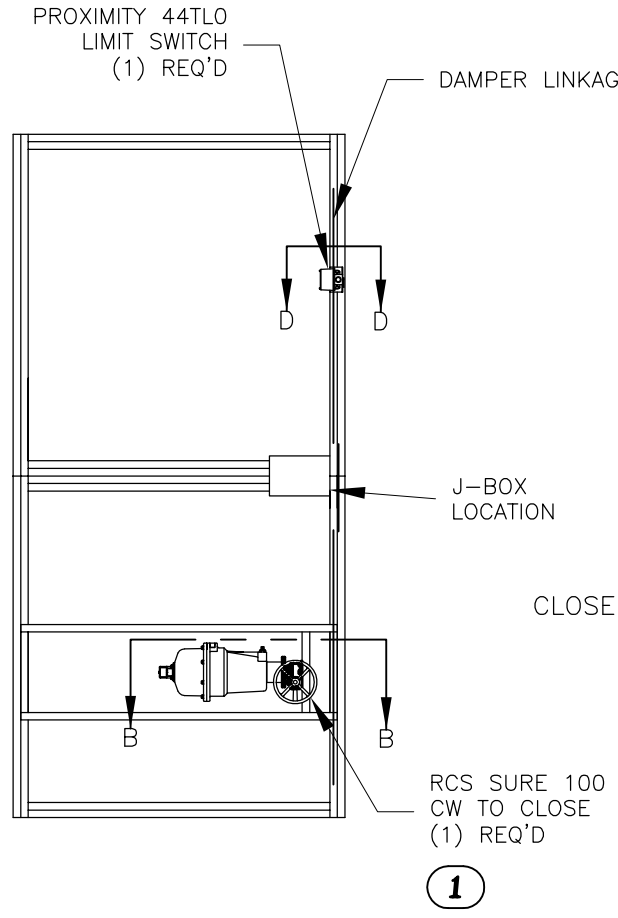


FACE VIEW
TAG: FI1,FI2,FI3
AS VIEWED FROM THE FRONT, ACTUATOR MOUNTING SIDE (1.5" FLANGE)

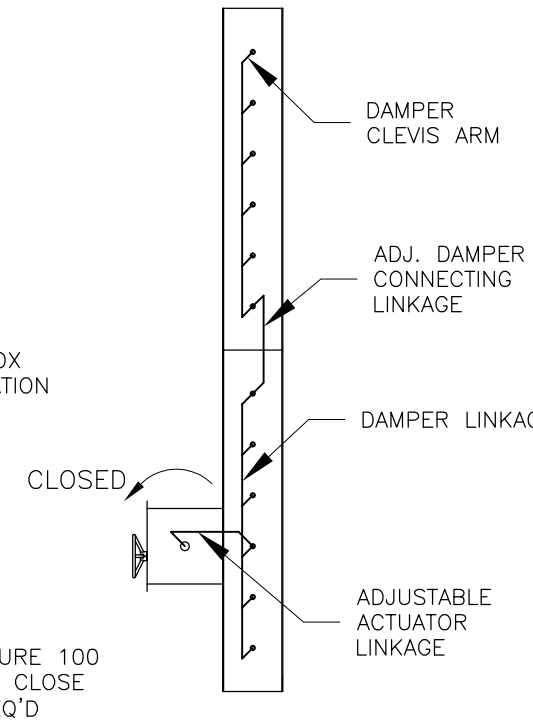
END VIEW 1
TAG: FI1,FI2,FI3
LINKAGES SHOWN IN CLOSED POSITION



FACE VIEW
TAG: TI-DS-1
AS VIEWED FROM THE FRONT, ACTUATOR MOUNTING SIDE (1.5" FLANGE)



FACE VIEW
TAG: TI-DS-2,3,4,5,6
AS VIEWED FROM THE FRONT, ACTUATOR MOUNTING SIDE (1.5" FLANGE)



END VIEW 1
TAG: TI-DS-1,2,3,4,5,6
LINKAGES SHOWN IN CLOSED POSITION

- ☐ FOR RECORD ONLY
- ☐ APPROVED
- ☐ APPROVED AS NOTED
- ☐ REVISE AND RE-SUBMIT

BY: _____

DATE: _____

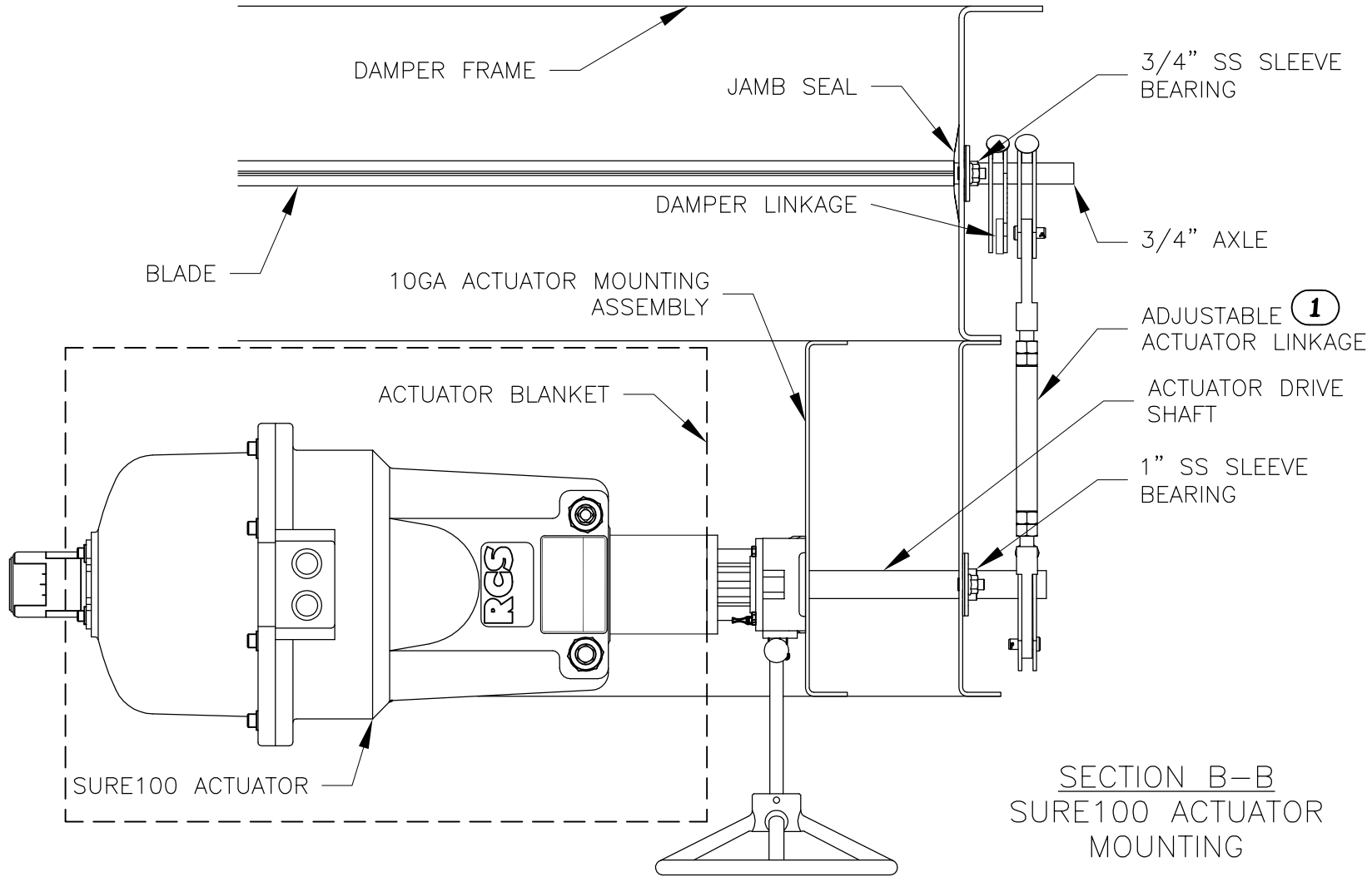
GREENHECK

TITLE

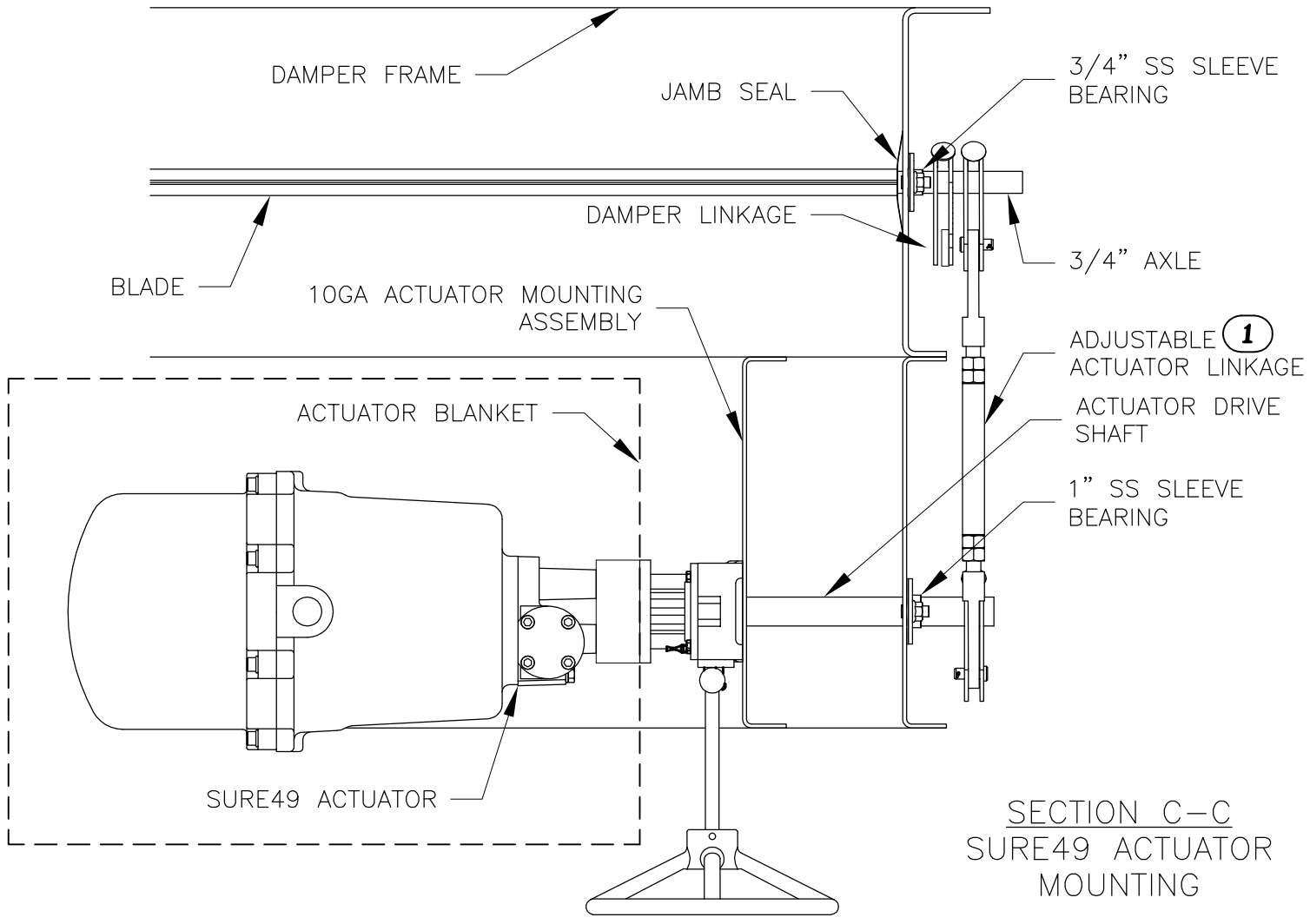
HTD-630 LYTLE TUNNEL ACCESSORY LOCATIONS

DRAWN BY: JRB	ECO: ----
DATE: 5/26/2015	ENG. REF.: ----
SUPERSEDES: ----	----
SCALE: 1/40	----
CAD DRAWING NO.: T243-003	---- B

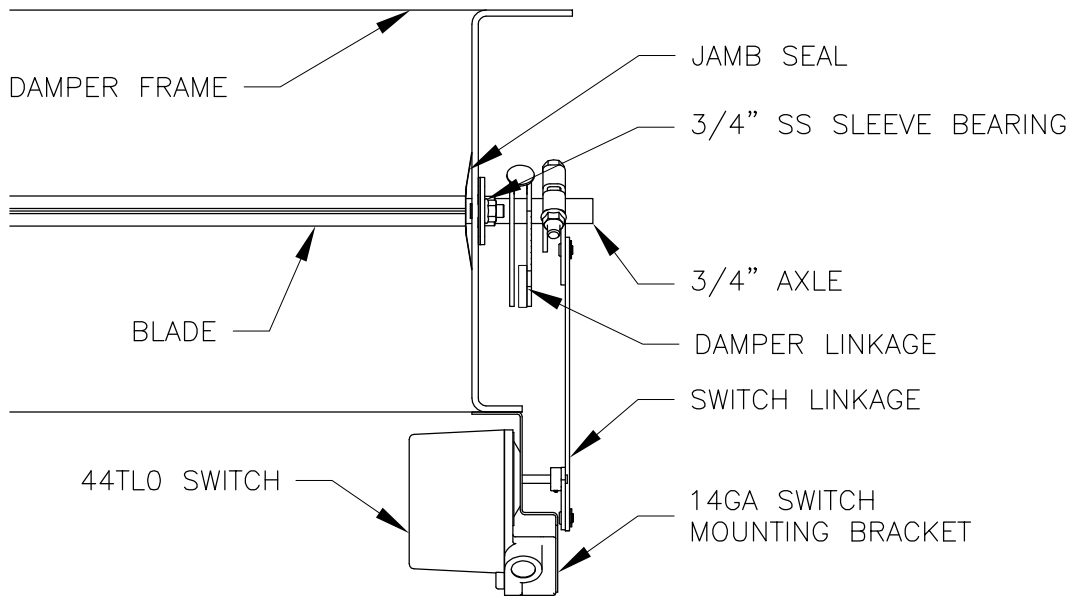
REVISION	DCR	BY	DATE	SYM
UPDATED ADJUSTABLE ACTUATOR LINKAGE TO CURRENT STANDARD		JLJ	03/11 2016	1



SECTION B–B
SURE100 ACTUATOR MOUNTING



SECTION C–C
SURE49 ACTUATOR MOUNTING



SECTION D–D
SWITCH MOUNTING

- ☐ FOR RECORD ONLY
- ☐ APPROVED
- ☐ APPROVED AS NOTED
- ☐ REVISE AND RE-SUBMIT

BY: _____

DATE: _____

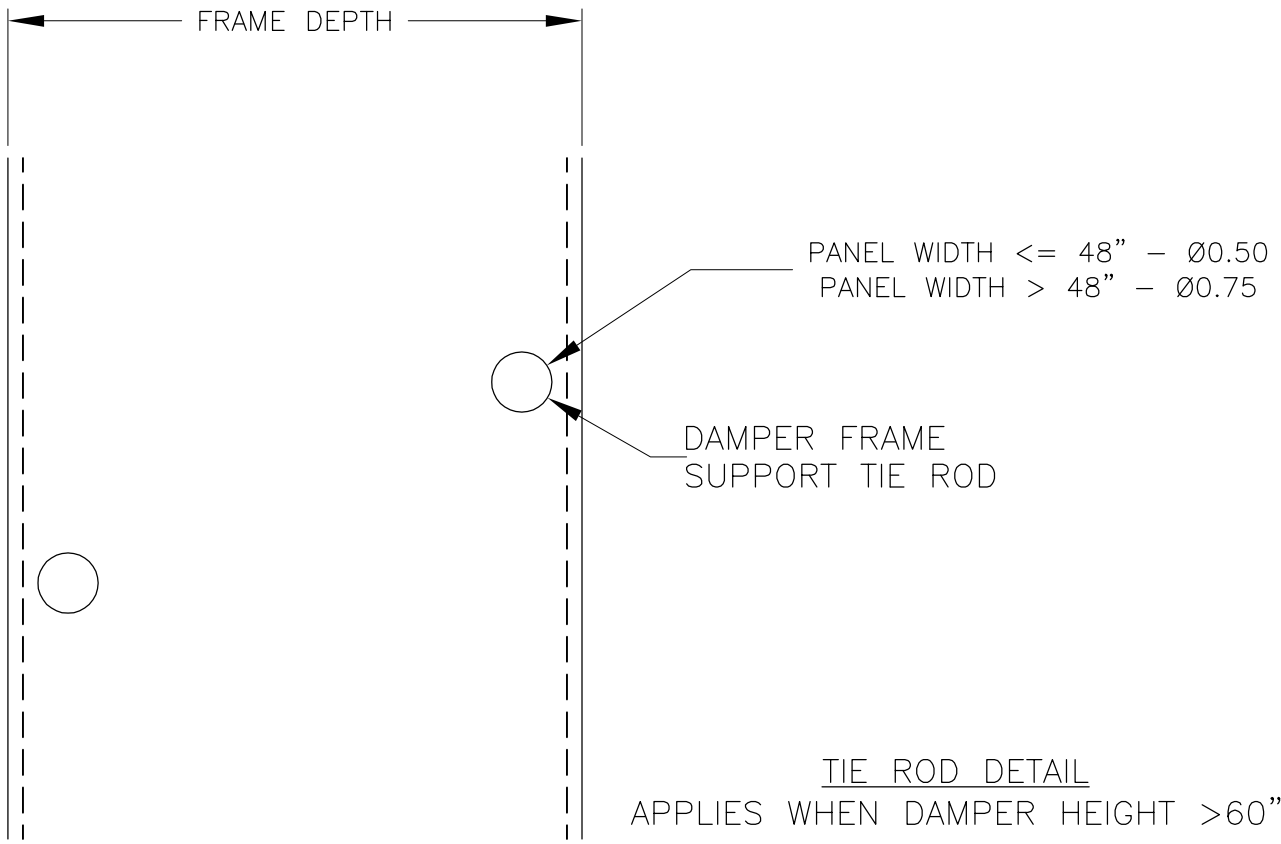
GREENHECK

TITLE

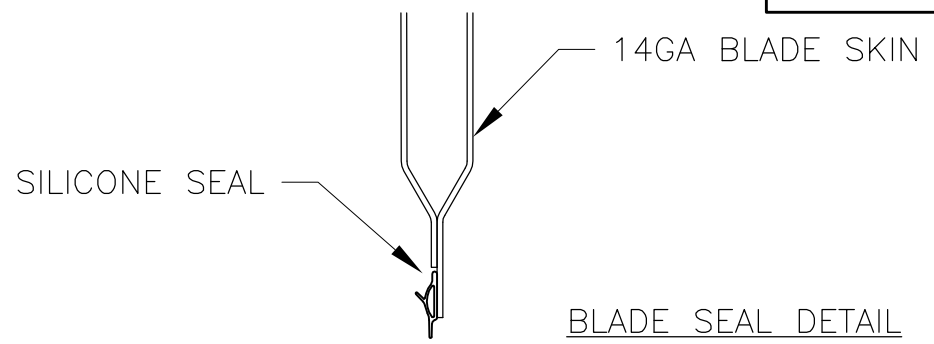
HTD–630 LYTLE TUNNEL ACCESSORY MOUNTING DETAILS

DRAWN BY: JRB	ECO: ----
DATE: 5/27/2015	ENG. REF.: ----
SUPERSEDES: ----	----
SCALE: 1/6	----
CAD DRAWING NO.: T243–004	---- B

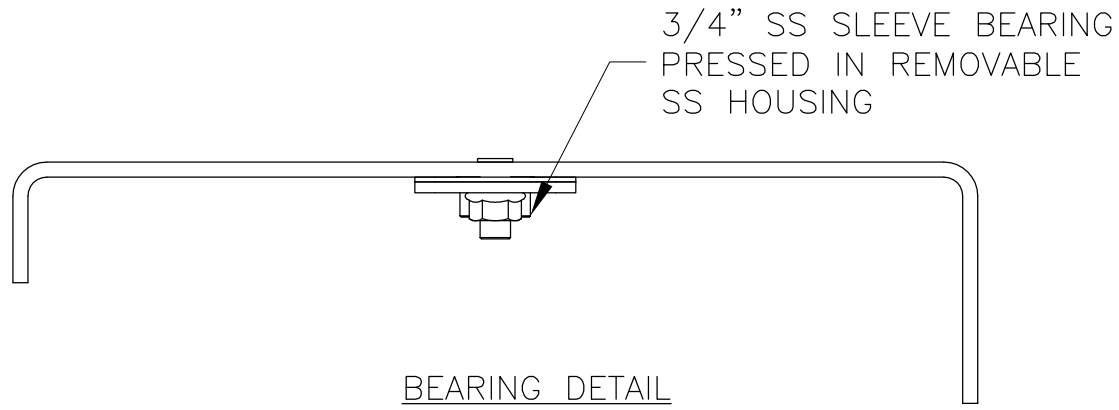
REVISION	SYM
-	-



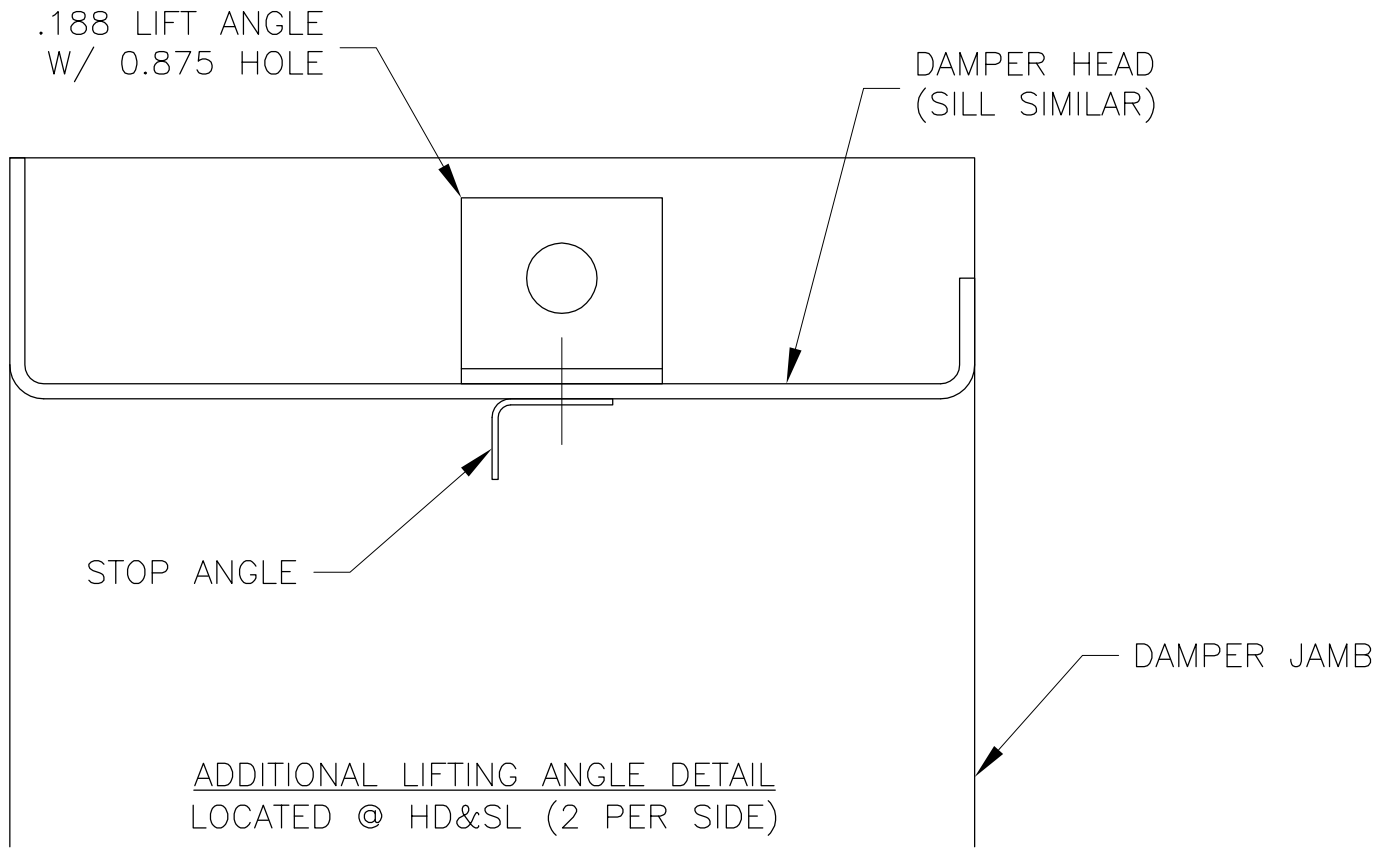
TIE ROD DETAIL
APPLIES WHEN DAMPER HEIGHT >60"



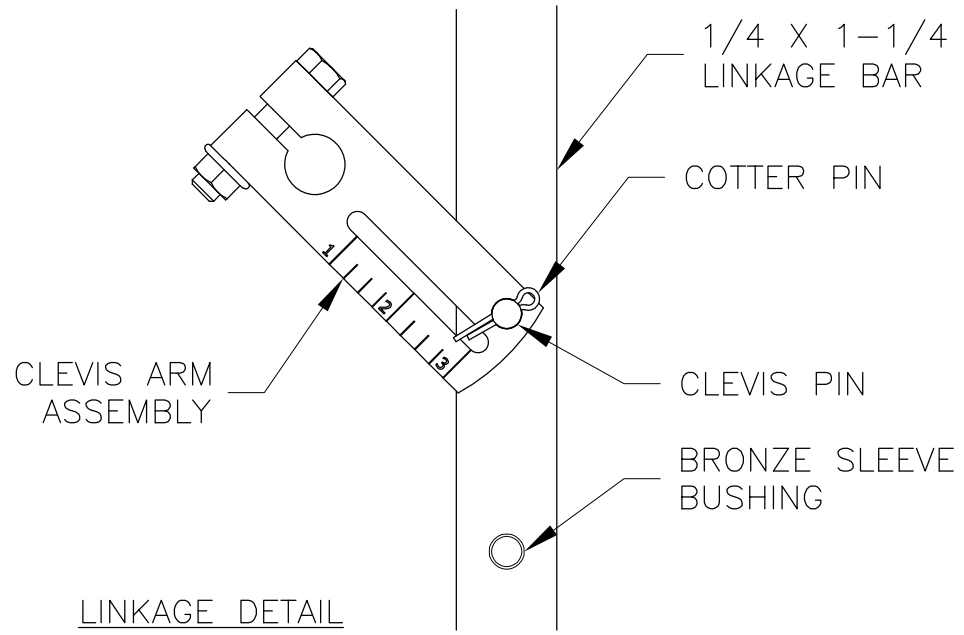
BLADE SEAL DETAIL



BEARING DETAIL



ADDITIONAL LIFTING ANGLE DETAIL
LOCATED @ HD&SL (2 PER SIDE)



LINKAGE DETAIL

- ☐ FOR RECORD ONLY
- ☐ APPROVED
- ☐ APPROVED AS NOTED
- ☐ REVISE AND RE-SUBMIT

BY: _____

DATE: _____

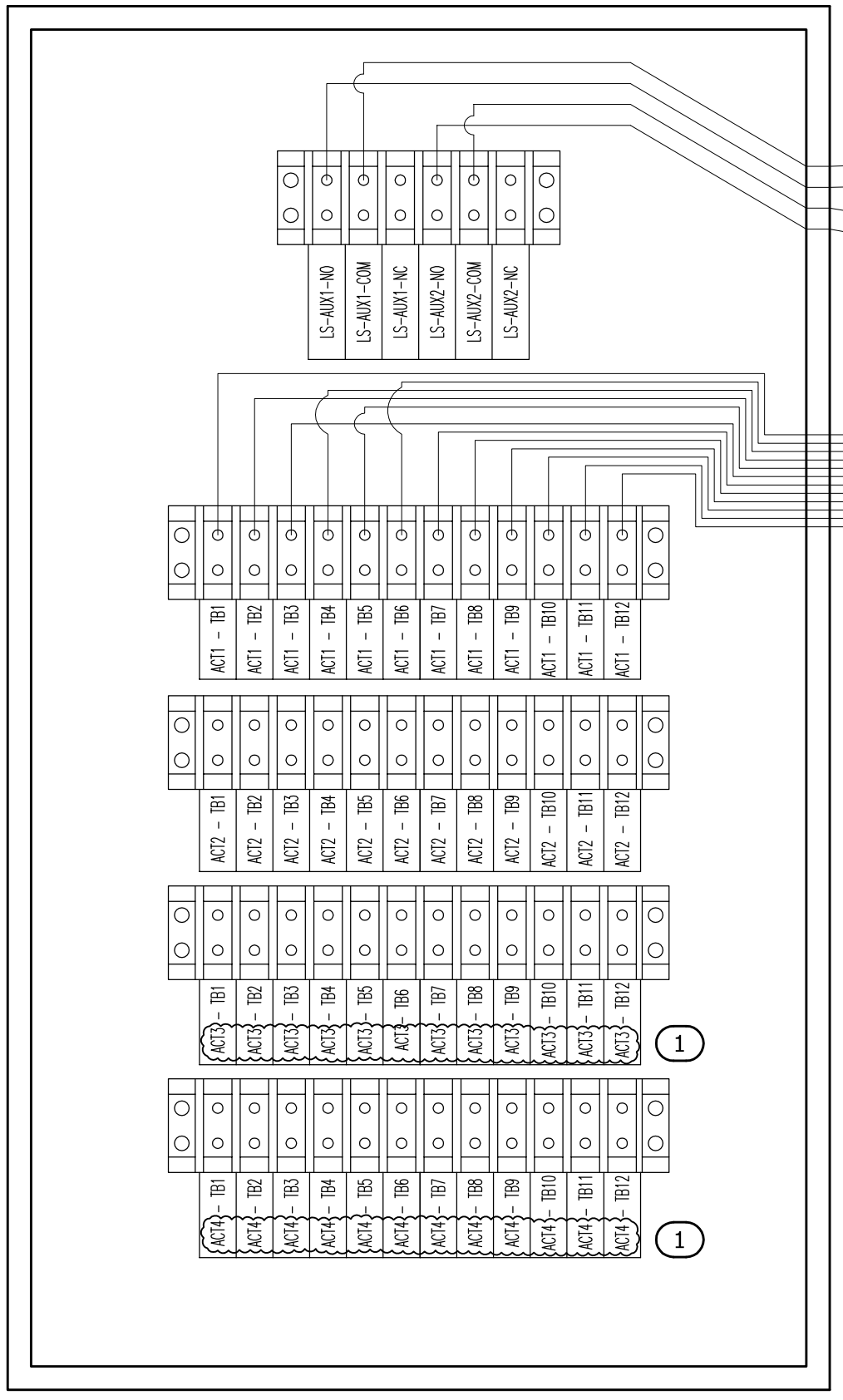
GREENHECK

TITLE

HTD-630 LYTLE
TUNNEL DAMPER
CONSTRUCTION DETAILS

DRAWN BY: JRB	ECO: ----
DATE: 5/27/2015	ENG. REF.: ----
SUPERSEDES: ----	----
SCALE: 1/2.5	----
CAD DRAWING NO.: T243-005	B

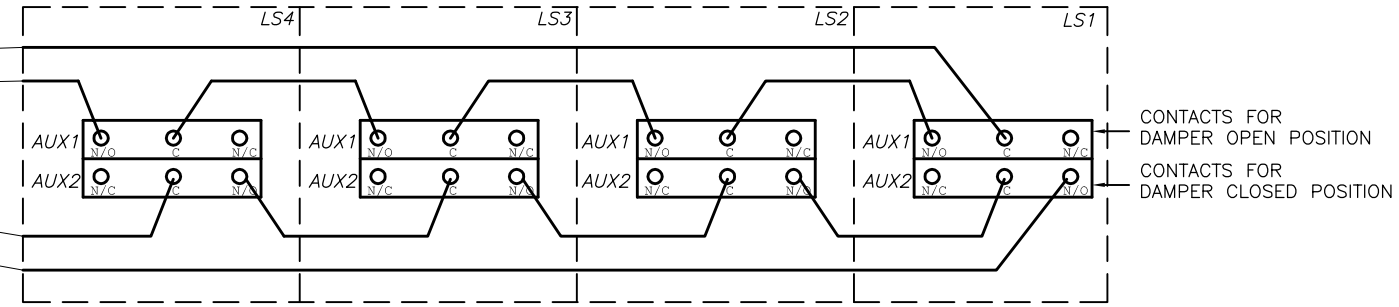
REVISION	DCR	BY	DATE	SYM
REVISED NOTES		JLJ	03/10 2016	1

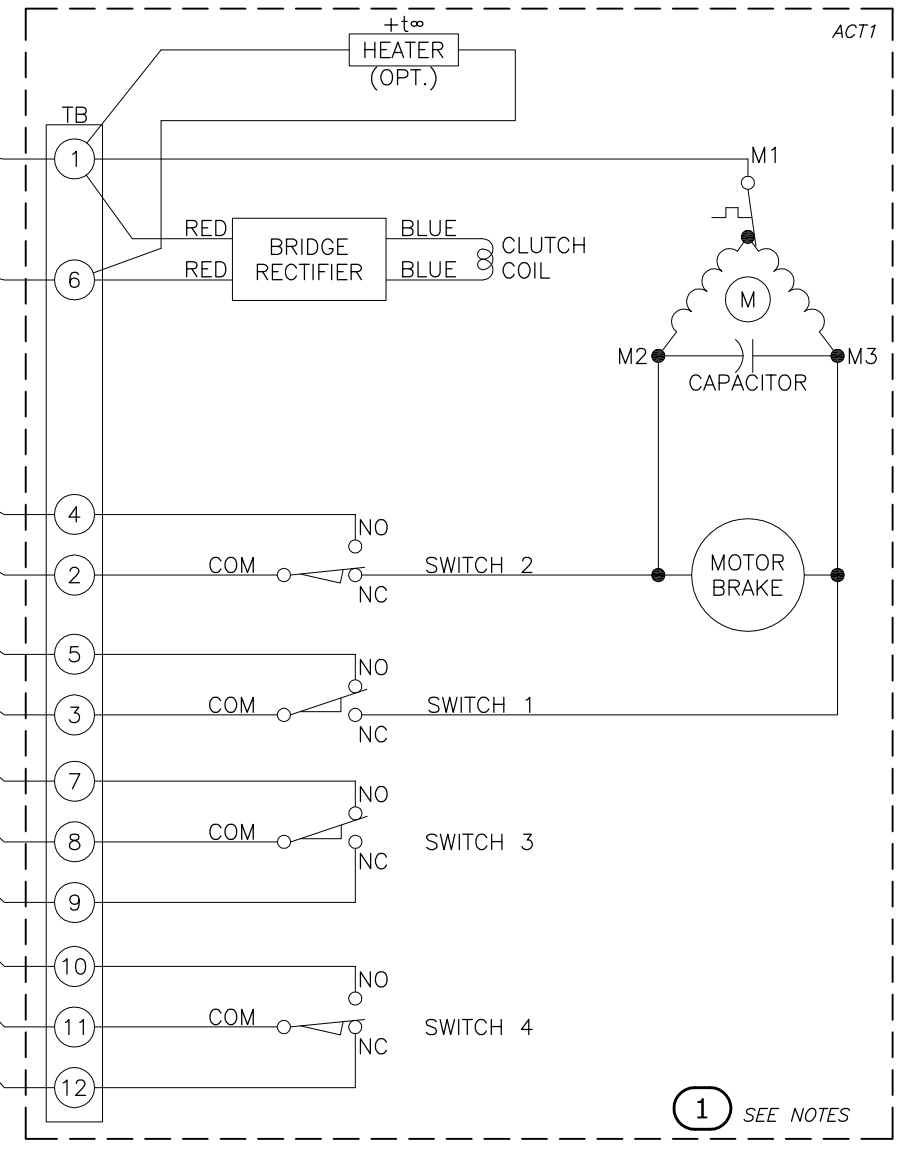


ACT2 WIRING ENTRY
(IF APPLICABLE)
(SAME AS ACT1)

ACT3 WIRING ENTRY
(IF APPLICABLE)
(SAME AS ACT1)

ACT4 WIRING ENTRY
(IF APPLICABLE)
(SAME AS ACT1)





NOTES: (1)

1. ACTUATOR WIRING SHOWN IS GENERIC.
2. REFERENCE SUBMITTAL SECTION 5–ACTUATOR INFORMATION FOR SIZE/ROTATION–SPECIFIC WIRING DIAGRAMS BY MANUFACTURER.
3. REFERENCE DRAWING T243–003 FOR ACTUATOR SIZE/ROTATION BY DAMPER LOCATION.

☐ FOR RECORD ONLY
☐ APPROVED
☐ APPROVED AS NOTED
☐ REVISE AND RE–SUBMIT

BY: _____

DATE: _____

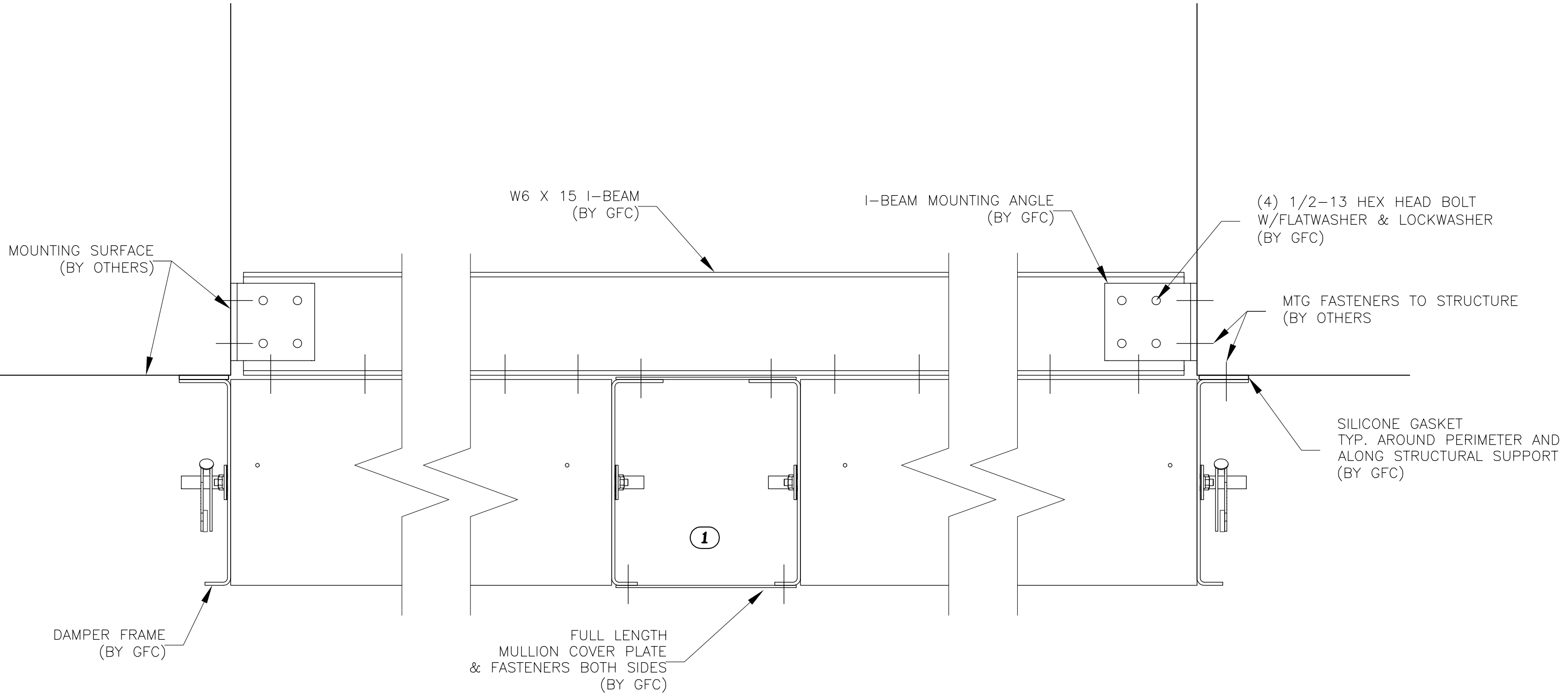
GREENHECK

TITLE

HTD–630 LYTLE
TUNNEL JUNCTION BOX
LAYOUT

DRAWN BY: JRB	ECO: ----
DATE: 05/28/2015	ENG. REF.: ----
SUPERSEDES: ----	----
SCALE: 1/2	----
CAD DRAWING NO.: T243–006	---- B

REVISION	DCR	BY	DATE	SYM
UPDATED MULLION DESIGN		JRB	06-22 2016	1



SECTION E-E

- ☐ FOR RECORD ONLY
- ☐ APPROVED
- ☐ APPROVED AS NOTED
- ☐ REVISE AND RE-SUBMIT

BY: _____

DATE: _____

GREENHECK

TITLE

HTD-630 LYTLE
TUNNEL INSTALLATION
DETAILS

DRAWN BY: JRB	E.C.O.: ----
DATE: 05/29/2015	ENG. REF.: ----
SUPERSEDES: ----	----
SCALE: 1/6	----
CAD DRAWING NO.: T243-007	---- B