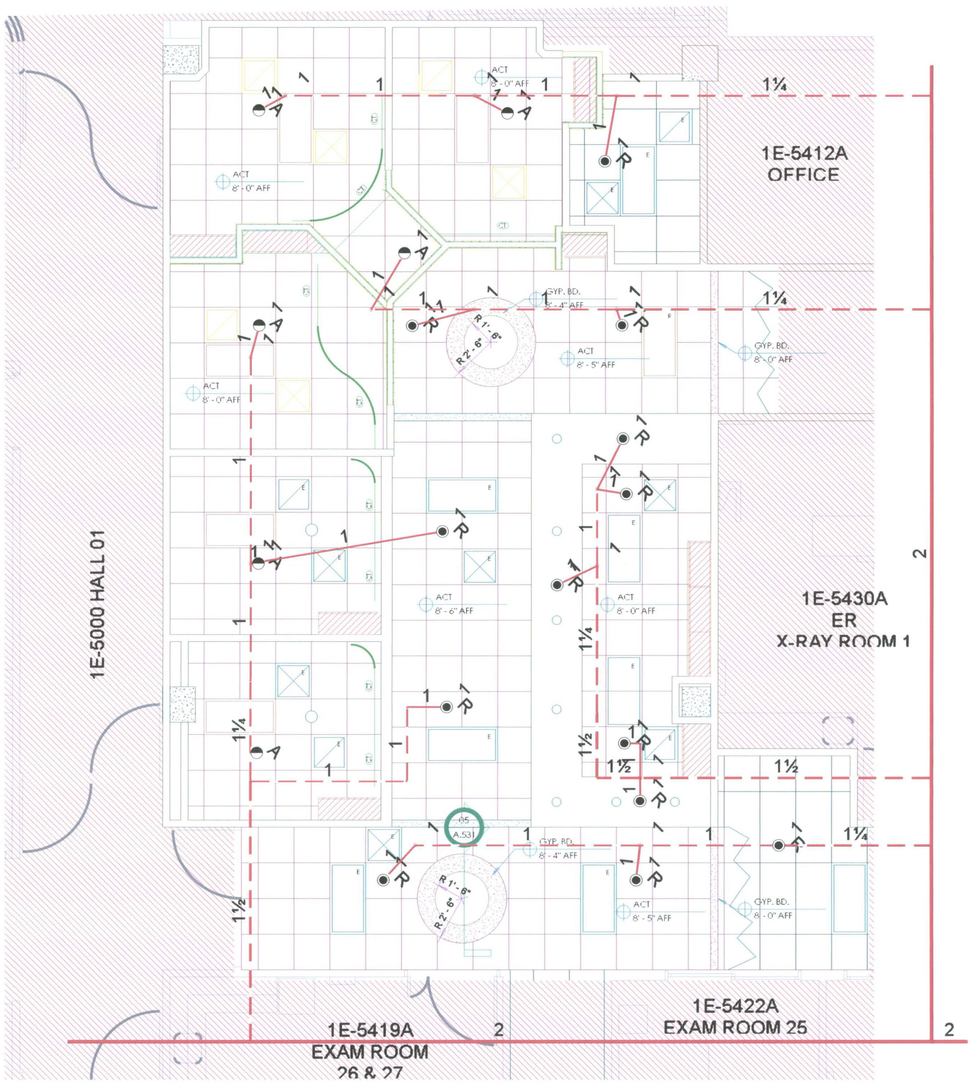
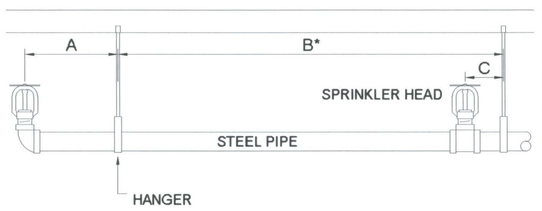


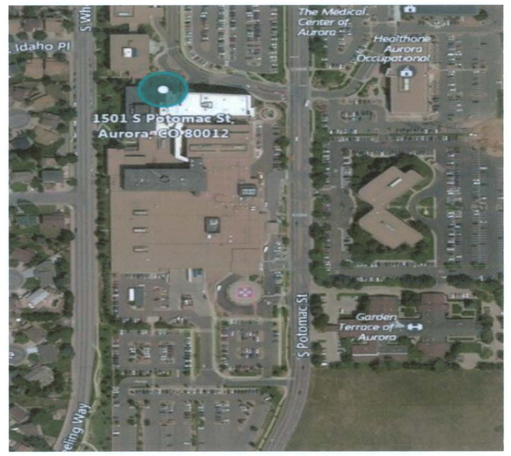
SUPPLIED FROM EXISTING FIRE PUMP

STEEL PIPE HANGER LOCATION DETAIL

PIPE SIZE	A	B*	C
1"	3'-0" MAX.	12'-0" MAX.	3" MIN.
1¼"	4'-0" MAX.	12'-0" MAX.	3" MIN.
1½"-8"	5'-0" MAX.	15'-0" MAX.	3" MIN.

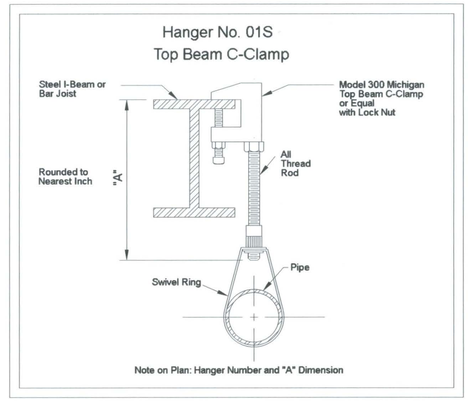


* MAXIMUM HANGER SPACING FOR THREADED LIGHTWALL STEEL PIPE IS 12'-0" FOR ALL PIPE SIZES



13- RELIABLE QUICK RESPONSE CONCEALER SPRINKLERS

6- TYCO RAVEN INSTITUTIONAL SPRINKLERS



1. MODIFY THE EXISTING SYSTEM IN AREA OF WORK TO COMPLY WITH NFPA 13, 2016 FOR NEW WALL & CEILING CONFIGURATION
2. ALL RELOCATED SPRINKLER HEADS TO BE REPLACED WITH NEW QUICK RESPONSE SPRINKLERS
3. EXISTING PIPE IS SHOWN AS DASHED LINES
4. SYSTEM MODIFICATIONS TO BE DESIGNED, INSTALLED, AND TESTED PER NFPA 13, 2016
5. EXISTING SYSTEM DESIGNED FOR LIGHT HAZARD OCCUPANCY EXCEPT STORAGE AND MECHANICAL ROOMS
6. NO MORE THAN TWO SPRINKLERS TO BE PIPED FROM ANY 1" OUTLET
7. OWNER TO PROVIDE ADEQUATE HEAT TO ALL PLACES WHERE WET SPRINKLER PIPE IS INSTALLED.
8. ALL PAINTING AND WIRING OF DEVICES (IF REQUIRED) TO BE DONE BY OTHERS PER CONTRACT
9. UPON COMPLETION OF THE PROJECT IT IS THE OWNER'S RESPONSIBILITY TO INSPECT, TEST AND MAINTAIN THE SPRINKLER SYSTEM PER NFPA 25

City of Aurora Building Division
Reviewed for Code Compliance
Approved as Noted: John J Van Essen
Date: Dec 02, 2016
2015 INTERNATIONAL CODES & 2014 NEC
2013 NFPA 13
RSN: 1167877
Permit #2016-1214775-CT

Thomas M. Coakley
Western States Fire Protection Co.
Nicet Level III
Registration #107852
NOV 23 2016
Shop Drawing System Layout
Signature:

SPRINKLER LEGEND

BY	SYMBOL	DESCRIPTION	SIN	ORIF.	TEMP.	COLOR	COUNT
		RELIABLE G5-56 CONCEALER HEADS	RA3415	1/2"	155°	WHITE	13
		TYCO RAVEN INSTITUTIONAL SPRINKLERS	TY3281	1/2"	155°	WHITE	6

REVISIONS

NO.	DATE	DESCRIPTION
1	11/23/16	

Western States Fire Protection Co.
7026 South Tucson Way
Centennial, Colorado 80112
Tel.: 303-792-0022 Fax: 303-792-9049
Colorado State Registration Number 032

DRAWN BY: JOSEPH HAGAN
DATE: 11-17-2016

THE MEDICAL CENTER OF AURORA
PEDIATRICS ED
1501 POTOMAC STREET
AURORA, CO 80012

CONTRACT NUMBER
BG5047

1ST FLR PEDIATRIC ED

NORTH

FP-1.0

RSN: *1167877*
Permit #*2016-1214775-CT*

Western States Fire Protection Co.

Protecting Lives and Property

Fire Sprinkler Systems

Material Data

For

The Medical Center of Aurora
Emergency Department
1st floor

1501 S. Potomac street
Aurora, Co 80012

Prepared by:
Joseph Hagan
Project Manager

Western States Fire Protection Co.
7026 S. Tucson Way
Centennial, CO 80112

(303) 792-0022
Fax: (303) 792-9049
Email: joe.hagan@wsfp.us

WSFP# BG5047
November 28, 2016

RSN: 1167877
Permit #2016-1214775-CT

Bulletin 034 Rev. C

Model G5-80, Model G5-56, Model G5-42, Model G5-28 Quick Response Concealed Automatic Sprinkler

UL Quick Response
FM Standard Response
Concealed Sprinkler With a ¾" (19mm) Adjustment

Features

1. Cover plate attachment (Plain or Perforated) with ¾" (19mm) assembly adjustment.
2. Smooth aesthetic ceiling profile.
3. Factory installed protective cap.
4. Available in Chrome and White as Standard Finishes. Special Application Finishes are also available.
5. Ordinary and Intermediate temperature rating.

For additional Sprinklers refer to Bulletin 154 for Technical Specification and Approvals

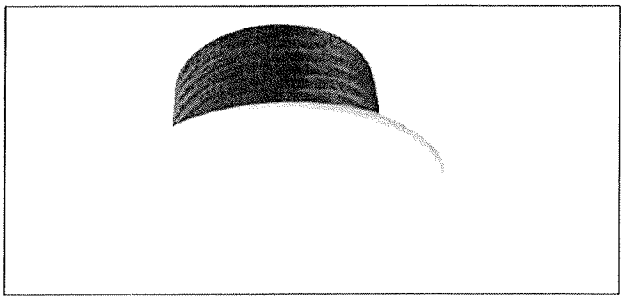
Approvals & Listings

1. Underwriters Laboratories Inc. and cULus - Quick Response
   - G5-80, G5-56 - Light Hazard and Ordinary Hazard Occupancies
   - G5-42 - Light Hazard Occupancies
   - G5-28 - Light Hazard Occupancies
2. Factory Mutual Research Corp. (FM) - Standard Response (See Page 3)
   - See the most recent FM Global Property Loss Prevention Data Sheets for installation and use guidelines.
3. Loss Prevention Council (LPCB, UK) - Standard Response
   - G5-56 - Light Hazard and Ordinary Hazard Occupancies
4. VdS Schadenverhütung GmbH - Standard Response
5. EC-Certificate of Conformity 0832-CPD-2062

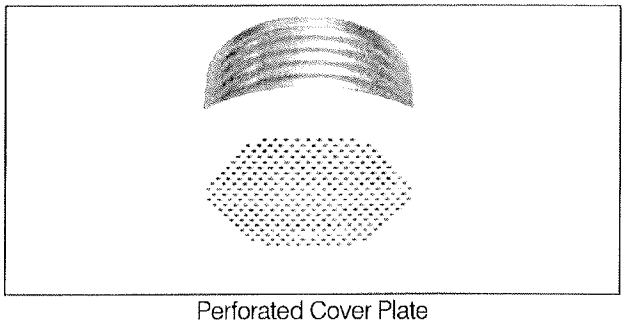
U.S. Patent number 6,554,077.

Application

The Reliable Model G5-80, G5-56, G5-42 and G5-28 are the most versatile quick response concealed sprinklers available. It provides the best form of fire protection while offering an attractive appearance and ¾" (19mm) of cover adjustment for ease of installation. The small diameter cover plate assembly is easily attached and blends into the ceiling, concealing the most dependable fire protection available, an automatic sprinkler system.



Plain Cover Plate



Perforated Cover Plate

The Model G5-80, G5-56, G5-42 and G5-28 are designed for use where aesthetic appearance is important. Offices, hospitals, motels and restaurants are but a few of the applications where it can be used.

The Model G5-80, G5-56, G5-42 and G5-28 are UL Listed Quick Response Concealed sprinklers intended for use in accordance with NFPA 13. FM Approves the G5-56 and the G5-28 sprinkler as a standard response concealed sprinkler intended for use in accordance with FM Loss Prevention Data Sheet 2.0.

Product Description

The Reliable Model G5-80, G5-56, G5-42 and G5-28 uses a proven quick response fusible element in a standard style sprinkler frame with a drop-down deflector. This assembly is recessed into the ceiling and concealed by a flat cover plate assembly. The threaded engagement provides ¾" (19mm) of cover adjustment. The flat cover plate is attached to the skirt using either 135°F (57°C) or 165°F (74°C) ordinary temperature classification solder.

When the ceiling temperature rises, the solder holding the flat cover plate melts, the flat cover plate released thus exposing the sprinkler inside to the rising ambient temperature.

The subsequent fusing of the element opens the waterway and causes the deflector to distribute the water. Any secure engagement between the cover plate and cup will assure that the drop-down deflector is properly located below the ceiling.

Installation

Do not install the G5-80, G5-56, G5-42 and G5-28 in ceilings which have positive pressure in the space above.

- Cut a 2⅝" inch (67mm) diameter hole is cut in the ceiling, the sprinkler is easily installed with the Model FC Wrench. The wrench has a socket drive which is inserted into the body of the sprinkler. When installing a sprinkler the wrench is first positioned into the sprinkler/cup assembly until the wrench socket engages the body of the sprinkler. The sprinkler is then tightened into the pipe fitting. When inserting or removing the wrench from the sprinkler/cup assembly, care should be taken to prevent damage to the sprinkler. DO NOT WRENCH ON ANY OTHER PART OF THE SPRINKLER/CUP ASSEMBLY. Install the cover plate by hand turning the cover in the clockwise direction until it is tight against the ceiling.

A protective cap is provided to protect the drop-down sprinkler deflector from damage which could occur during construction before the cover plate is installed. The cap is factory installed inside the sprinkler cup. Remove cap to install sprinkler, then re-install cap until the cover plate is installed.

Maintenance

The Model G5-80, G5-56, G5-42 and G5-28 should be inspected and the sprinkler system maintained in accordance with NFPA 25. Do not clean sprinklers with soap and water, ammonia or any other cleaning fluids. Remove any sprinkler that has been painted (other than factory applied) or damaged in any way. Concealed sprinklers cover plates can not be painted in the field, after installation or have any other coating applied other than the factory finish. A stock of spare sprinklers should be maintained to allow quick replacement of damaged or operated sprinklers. Prior to installation, sprinklers should be maintained in the original cartons and packaging to minimize the potential for damage to sprinklers that would cause improper operation or non-operation.

Ordering Information

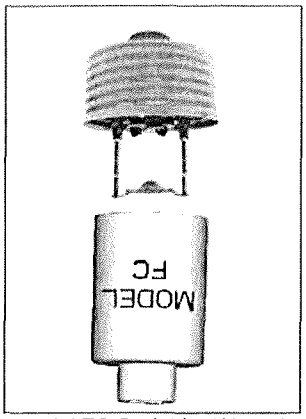
1. Sprinkler Model
2. Nominal Orifice
3. Flat Cover Plate
   Plain or Perforated
4. Flat Cover Plate
   Assembly Finish
5. Inlet Type

Cover Plate Finishes[1]

Standard Finishes
Chrome
White Paint
Special Application Finishes[2]
Bright Brass
Finished Bronze
Black Plating
Black Paint
Off White
Satin Chrome

[1] Other finishes and colors are available on special order. Consult factory for details. Coverplate custom paint is semi-gloss, unless specified otherwise.

[2] For the perforated style coverplate, consult factory for availability on these and other custom finishes.



Model FC Sprinkler Wrench

UL Listing Category

Sprinklers, Automatic and Open
Quick Response Sprinkler

UL Guide Number

VNIV

Maximum Working Pressure

175 psi (12 bar)
100% Factory tested Hydrostatically to 500 psi (34.5 bar)

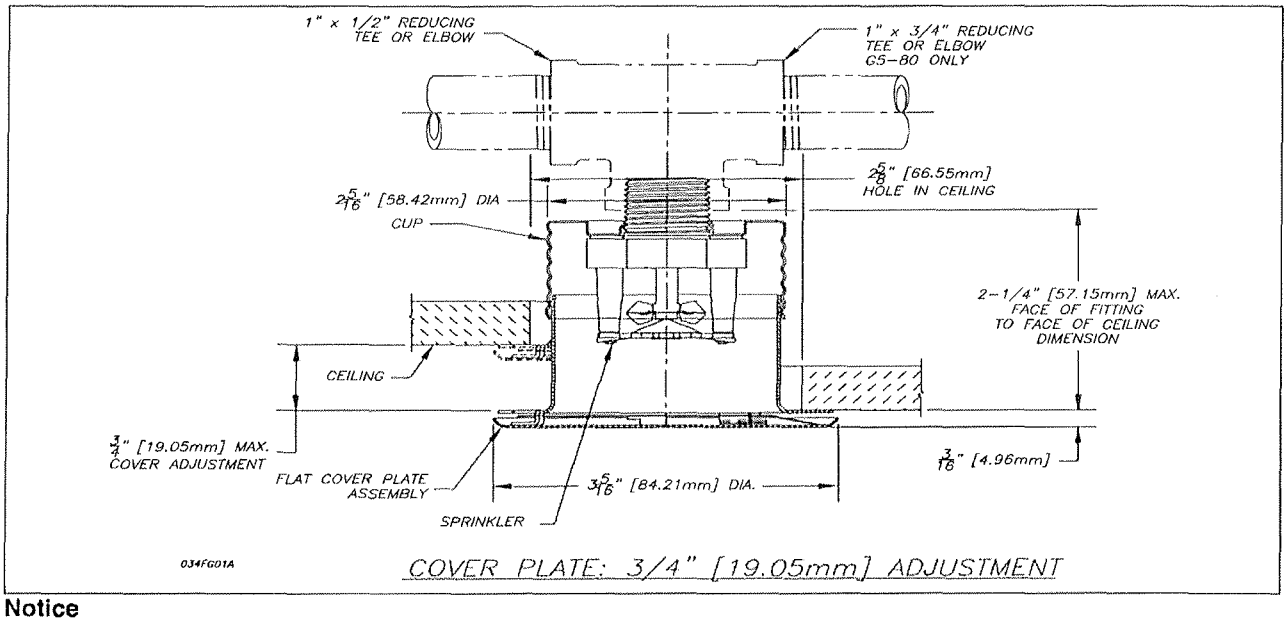
Temperature Rating

Classification	Sprinkler	Cover Plate	Max. Ambient Temp.
Ordinary	165°F/74°C	135°F/57°C	100°F/38°C
Intermediate	212°F/100°C	165°F/74°C	150°F/66°C

Technical Data

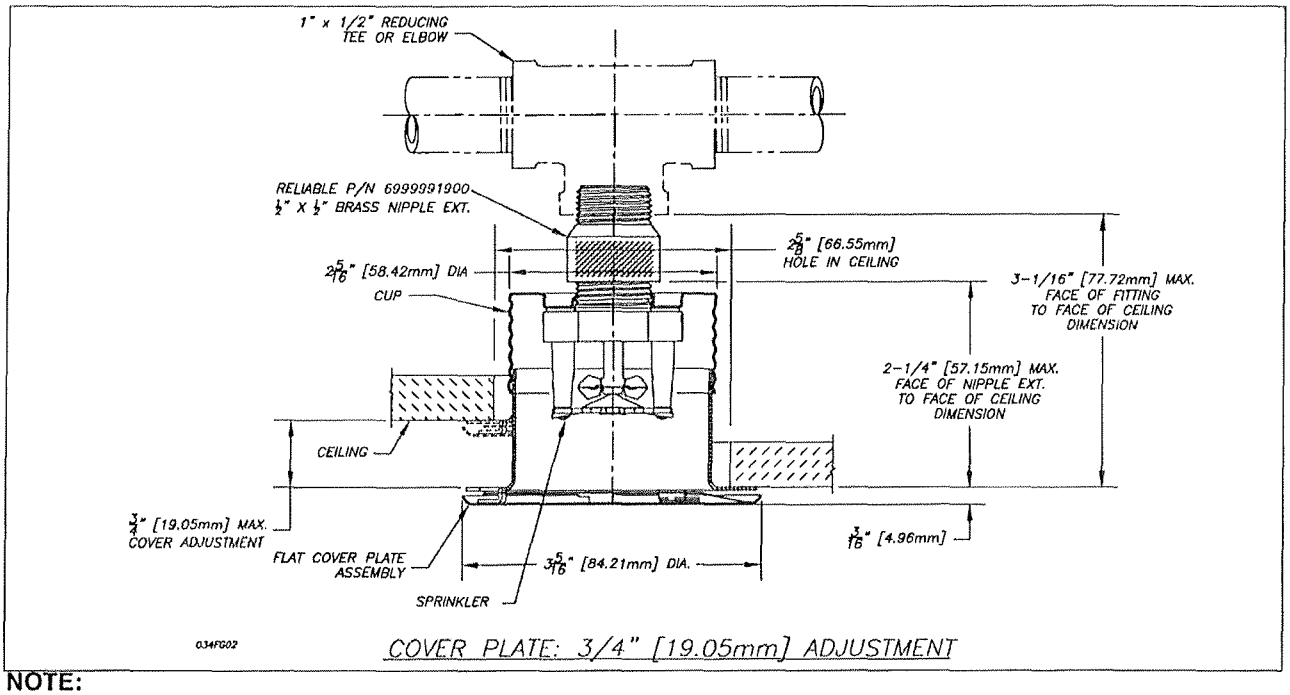
Sprinkler Model	Sprinkler Inlet	Total Adjustment	Nominal Orifice	Nominal K Factor		Thread	Approvals	Sprinkler Identification (SIN)
				US	Metric			
G5-80	Non Adjustable	¾" (19mm)	17/32" (15mm)	8.0	115	¾" NPT (R¾)	1	RA3412
G5-56	Non Adjustable	¾" (19mm)	½" (15mm)	5.6	80	½" NPT (R½)	1,2,3,4,5	RA3415
G5-42	Non Adjustable	¾" (19mm)	7/16" (10mm)	4.2	60	½" NPT (R½)	1	RA3413
G5-28	Non Adjustable	¾" (19mm)	3/8" (10mm)	2.8	40	½" NPT (R½)	1,2	RA3411

For VdS Approval, temperature rating sprinkler 165°F/74°c and cover plate 135°F/57°C only!



Notice

FOR USE AS A REPLACEMENT OF MODEL G4A SPRINKLERS



NOTE:

1. Testing has shown that use of a "nipple extension" will not affect the listing of the sprinkler.
2. For RETROFIT installations, per **NFPA 13 (2010) section 8.15.19.4,** "which allows the use of nipples as the same pipe thread size as the existing outlet when revamping existing systems".
3. Do not exceed 8-18 ft-lbs of torque during installation.

RSN: 1167877
Permit #2016-1214775-CT

Reliable...For Complete Protection

Reliable offers a wide selection of sprinkler components. Following are some of the many precision-made Reliable products that guard life and property from fire around the clock.

- Automatic sprinklers
- Flush automatic sprinklers
- Recessed automatic sprinklers
- Concealed automatic sprinklers
- Adjustable automatic sprinklers
- Dry automatic sprinklers
- Intermediate level sprinklers
- Open sprinklers
- Spray nozzles
- Alarm valves
- Retarding chambers
- Dry pipe valves
- Accelerators for dry pipe valves
- Mechanical sprinkler alarms
- Electrical sprinkler alarm switches
- Water flow detectors
- Deluge valves
- Detector check valves
- Check valves
- Electrical system
- Sprinkler emergency cabinets
- Sprinkler wrenches
- Sprinkler escutcheons and guards
- Inspectors test connections
- Sight drains
- Ball drips and drum drips
- Control valve seals
- Air maintenance devices
- Air compressors
- Pressure gauges
- Identification signs
- Fire department connection

The equipment presented in this bulletin is to be installed in accordance with the latest published Standards of the National Fire Protection Association, Factory Mutual Research Corporation, or other similar organizations and also with the provisions of governmental codes or ordinances whenever applicable.

Products manufactured and distributed by Reliable have been protecting life and property for over 90 years, and are installed and serviced by the most highly qualified and reputable sprinkler contractors located throughout the United States, Canada and foreign countries.

Manufactured by
Reliable®

The Reliable Automatic Sprinkler Co., Inc.
(800) 431-1588 Sales Offices
(800) 848-6051 Sales Fax
(914) 829-2042 Corporate Offices
www.reliablesprinkler.com Internet Address

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Revision lines indicate updated or new data.

EG. Printed in U.S.A. 04/14 P/N 9999970421

RSN: 1167877
Permit #2016-1214775-CT

tyco Fire Protection Products

Worldwide Contacts | www.tyco-fire.com

RAVEN 5.6K Institutional Sprinklers Pendent and Horizontal Sidewall Quick Response, Standard and Extended Coverage

General Description

TYCO RAVEN 5.6K Institutional Pendent and Horizontal Sidewall (HSW) Sprinklers are quick response spray sprinklers designed for use in areas such as correctional, detention, and mental health care facilities as well as other commercial buildings. Both the pendent and horizontal sidewall styles are available for Standard Coverage (light and ordinary hazard) or Extended Coverage (light hazard) applications.

- The assembly is designed with tamper-resistant features to help prohibit a false activation.
- This sprinkler is designed to operate when the Inner Link (Ref. Figure 1) is removed manually. While the design of this sprinkler makes manual removal of the Inner Link less likely, this feature negates the possibility of a tampered sprinkler placed in a condition where it would not operate in the event of a fire due to prior part removal.
- This protected, unobtrusive design helps reduce the opportunity for individuals to injure themselves or others with piecemeal components of the sprinkler.
- The flush design is aesthetically appealing by concealing all operating parts.

IMPORTANT

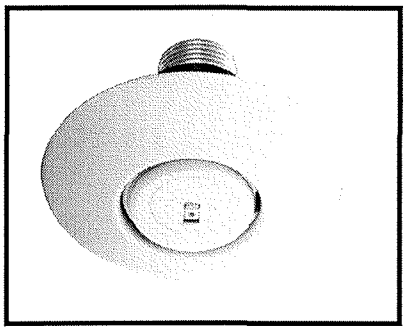
Always refer to Technical Data Sheet TFP700 for the "INSTALLER WARNING" that provides cautions with respect to handling and installation of sprinkler systems and components. Improper handling and installation can permanently damage a sprinkler system or its components and cause the sprinkler to fail to operate in a fire situation or cause it to operate prematurely.

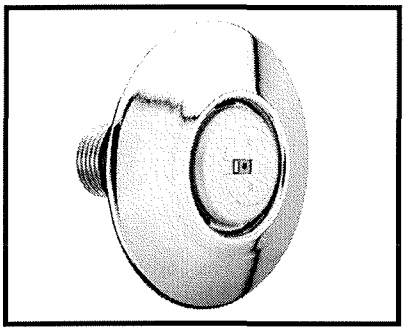
NOTICE

RAVEN Institutional Sprinklers described herein must be installed and maintained in compliance with this document and with the applicable standards of the National Fire Protection Association (NFPA), in addition to the standards of any authorities having jurisdiction. Failure to do so may impair the performance of these devices.

TYCO Fire Protection Products (TFPP) specifically disclaims any liability for damages or injury (including death) arising out of or caused by manipulation, dismantling, or misuse of RAVEN Institutional Sprinklers or the use or attempted use of the RAVEN Institutional Sprinklers or any component thereof as an instrument unrelated to its intended function as a fire protection device.

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. Contact the installing contractor or product manufacturer with any questions.





Sprinkler Identification Numbers (SINs)

SIN	DOT COLOR*	APPLICATION
TY3281	Black	Pendent Standard Coverage
TY3282	Green	Pendent Extended Coverage
TY3381	Red	HSW Standard Coverage
TY3382	Purple	HSW Extended Coverage

* Refer to Figures 1 through 4 for SIN Color Dot location.

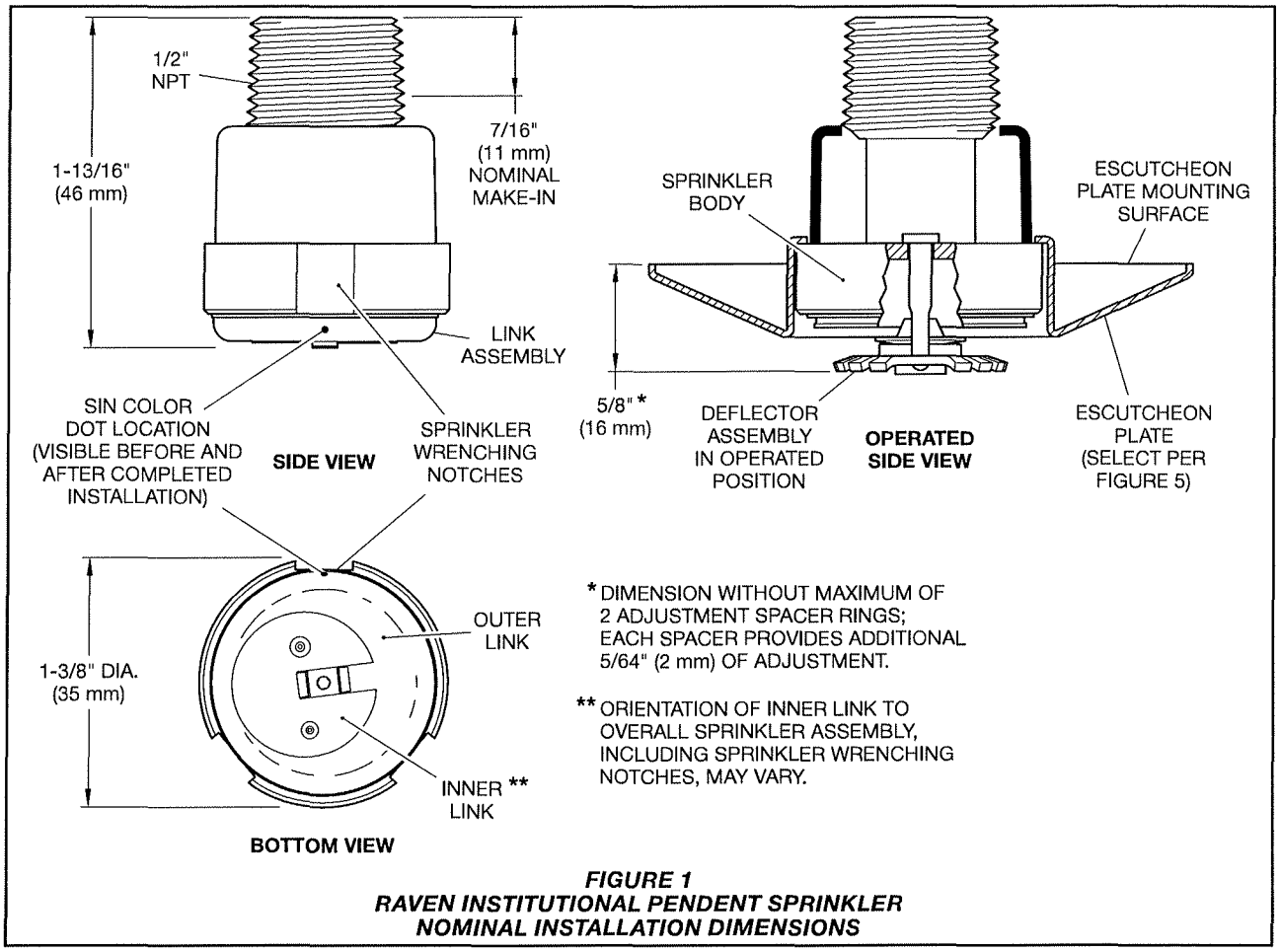


FIGURE 1
RAVEN INSTITUTIONAL PENDENT SPRINKLER
NOMINAL INSTALLATION DIMENSIONS

Technical Data

Approvals
UL and C-UL Listed

Maximum Working Pressure
175 psi (12,1 bar)

Inlet Thread Connection
1/2 inch NPT

Discharge Coefficient
K=5.6 gpm/psi$^{1/2}$ (80,6 lpm/bar$^{1/2}$)

Temperature Rating
165°F (74°C)

Finish
Sprinkler: White or Grey

Escutcheon: White, Grey, Chrome Coated (Carbon Steel only), or Electropolished* (Stainless Steel only)

Physical Characteristics

Body	Brass
Deflector Assembly	Bronze
Sealing Assembly	Beryllium Nickel w/TEFLON
Link Assembly	Copper
Escutcheon	Carbon Steel or Stainless Steel

* Chrome-coated appearance

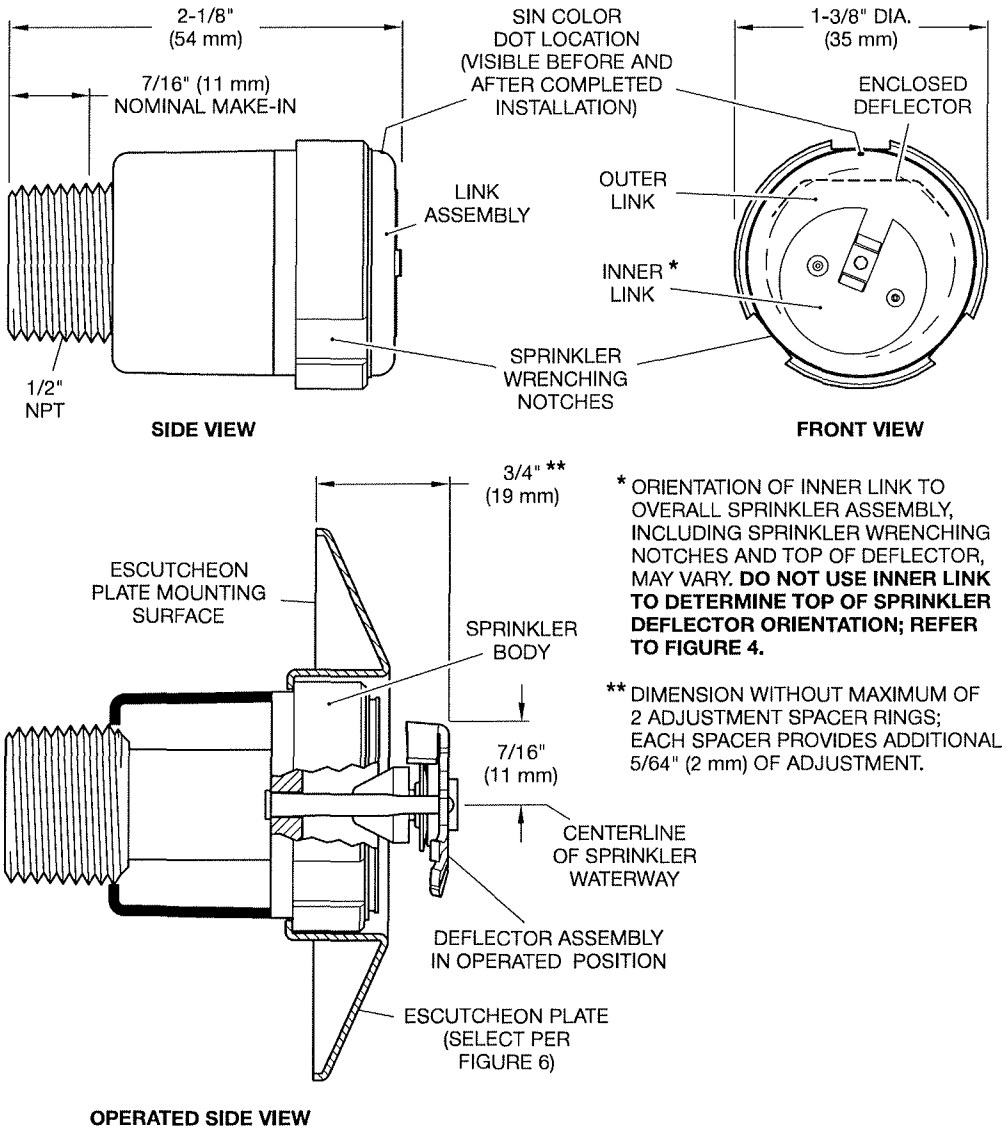


FIGURE 2
RAVEN INSTITUTIONAL HORIZONTAL SIDEWALL SPRINKLER
NOMINAL INSTALLATION DIMENSIONS

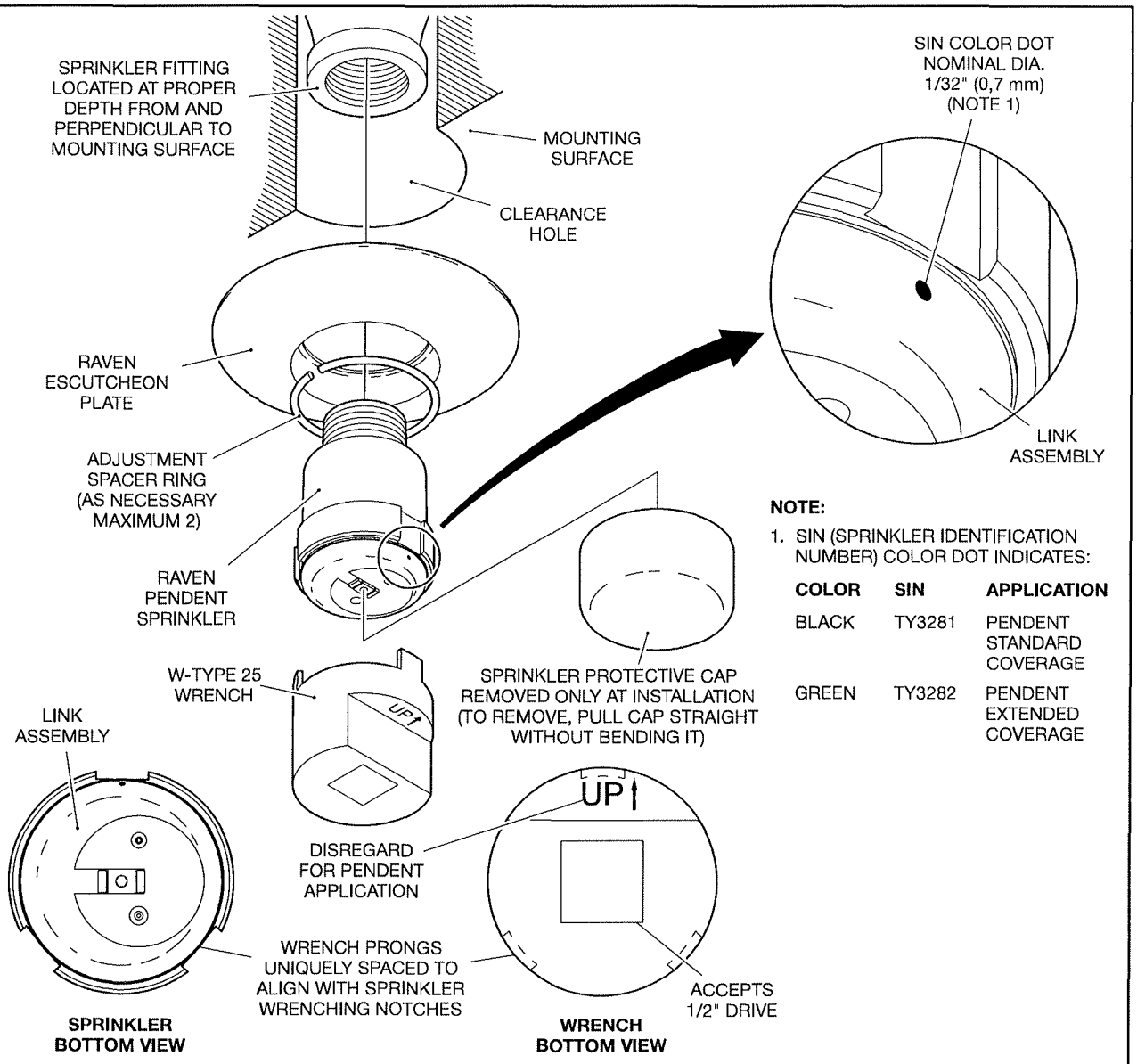
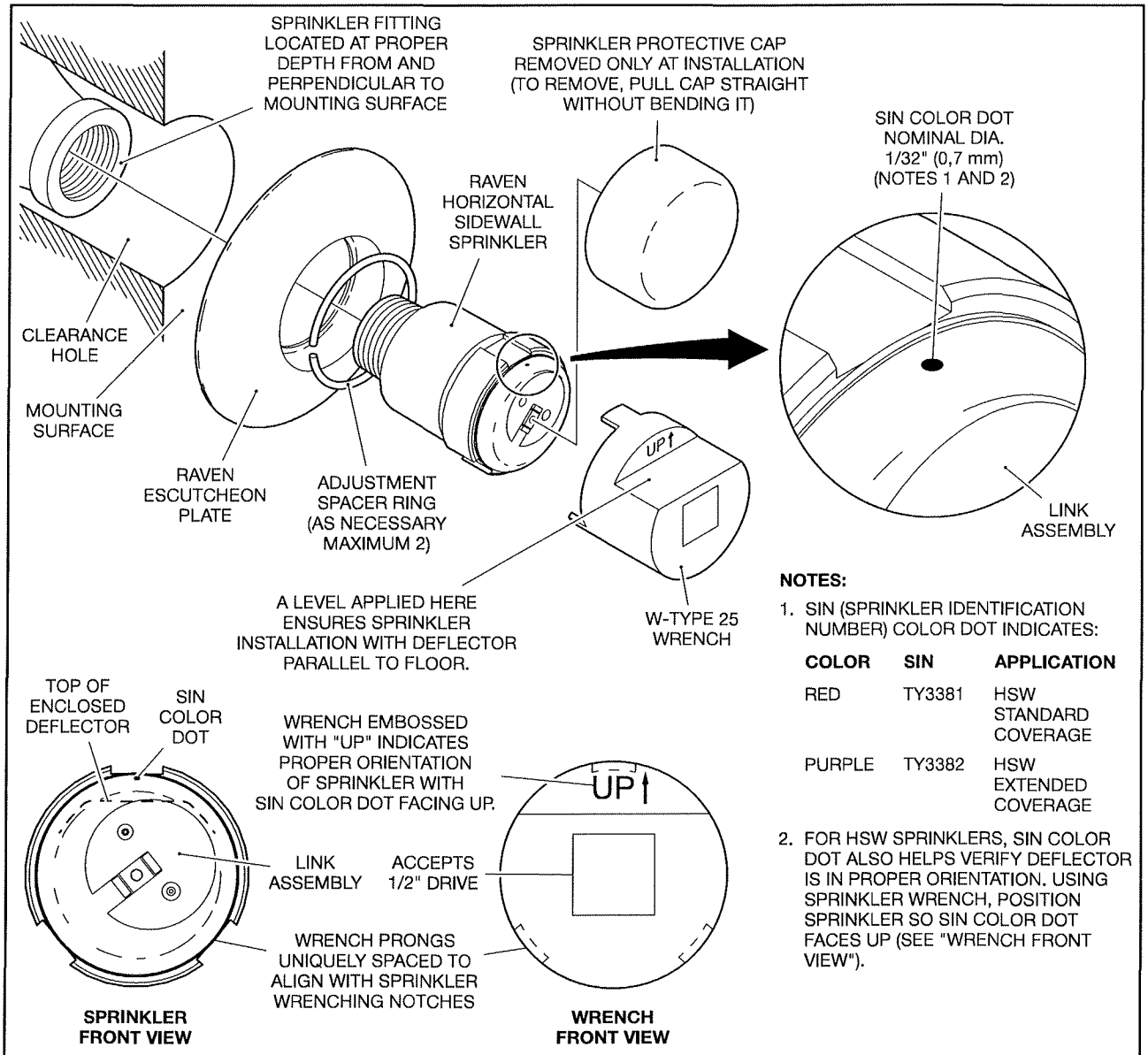


FIGURE 3
RAVEN INSTITUTIONAL PENDENT SPRINKLER INSTALLATION WITH W-TYPE 25 SPRINKLER WRENCH



NOTES:

1. SIN (SPRINKLER IDENTIFICATION NUMBER) COLOR DOT INDICATES:

COLOR	SIN	APPLICATION
RED	TY3381	HSW STANDARD COVERAGE
PURPLE	TY3382	HSW EXTENDED COVERAGE

2. FOR HSW SPRINKLERS, SIN COLOR DOT ALSO HELPS VERIFY DEFLECTOR IS IN PROPER ORIENTATION. USING SPRINKLER WRENCH, POSITION SPRINKLER SO SIN COLOR DOT FACES UP (SEE "WRENCH FRONT VIEW").

FIGURE 4
RAVEN INSTITUTIONAL HORIZONTAL SIDEWALL SPRINKLER INSTALLATION WITH W-TYPE 25 SPRINKLER WRENCH

5.6K Extended Coverage Pendent (TY3282)						
Response Rating	**Coverage Area Ft. x Ft. (m x m)**	**Minimum Flow [1] gpm (lpm)**	**Minimum Pressure [2] psi (bar)**	**Deflector-to-Ceiling Distance Inches (mm)**	**Sprinkler Temperature Rating °F (°C)**	**Minimum Spacing Ft. (m)**
Quick	16 x 16 (4,9 x 4,9)	26 (98)	21.6 (1,49)	Flush Mounted	165 (74)	8 (2,4)
5.6K Extended Coverage Horizontal Sidewall (TY3382)						
Response Rating	**Coverage Area Ft. x Ft. (m x m)**	**Minimum Flow [1] gpm (lpm)**	**Minimum Pressure [2] psi (bar)**	**Deflector-to-Ceiling Distance [3] Inches (mm)**	**Sprinkler Temperature Rating °F (°C)**	**Lateral Minimum Spacing [4] Ft. (m)**
Quick	16 x 16 (4,9 x 4,9)	26 (98)	21.6 (1,49)	4 to 12 (100 to 300)	165 (74)	8 (2,4)

Notes:
1. Requirement is based on minimum flow in gpm (lpm) from each sprinkler.
2. Indicated residual pressures are based on the nominal K-factor.
3. Centerline of the sprinkler waterway is located 7/16 inch (11,1 mm) below the deflector (Ref. Figure 7).
4. Minimum spacing is for lateral distance between sprinklers located along a single wall. Otherwise adjacent sprinklers (i.e., sidewall sprinklers on an adjacent wall, on an opposite wall, or pendent sprinklers) must be located outside of the maximum listed protection area of the extended coverage sidewall sprinkler being utilized.

TABLE A
RAVEN INSTITUTIONAL SPRINKLERS
UL AND C-UL LISTING EXTENDED COVERAGE AND FLOW RATE CRITERIA

Design Criteria

General Criteria
Only escutcheons shown in Figures 5 and 6 can be utilized with TYCO RAVEN 5.6K Institutional Pendent and Horizontal Sidewall Sprinklers. A maximum of two spacers can be used to adjust the escutcheons.

NOTICE

Use of more than two spacers may result in disabling the tamper-resistant design of TYCO RAVEN Institutional Sprinklers and, thereby, also disable its principle functions of helping to avoid false sprinkler operations and avoid the opportunity for individuals to injure themselves or others with components of the sprinkler.

Standard Coverage Criteria
RAVEN Standard Coverage, Institutional Pendent and Horizontal Sidewall Sprinklers (TY3281 and TY3381) are intended for use with fire protection systems designed in accordance with the standard installation rules recognized by the applicable listing or approval agency (e.g., UL Listing is based on NFPA 13 requirements).

RAVEN Horizontal Sidewall Sprinklers (TY3381) must be installed with a deflector-to-ceiling distance of 4 to 12 inches (100 to 300 mm). To meet this requirement, the centerline of the sprinkler waterway must be located 4-7/16 to 12-7/16 inches (112,7 to 315,9 mm) below the ceiling (Ref. Figure 7).

Extended Coverage Criteria
RAVEN Extended Coverage, Institutional Pendent and Horizontal Sidewall Sprinklers (TY3282 and TY3382) must be installed in accordance with the flow rate criteria provided in Table A. They must be installed and utilized in light hazard occupancies under smooth, flat, horizontal ceilings as outlined in the applicable installation standard recognized by the listing or approval agency (e.g., UL Listing is based on NFPA 13 requirements).

RAVEN Extended Coverage, Horizontal Sidewall Sprinklers (TY3382) must be installed with a deflector-to-ceiling distance of 4 to 12 inches (100 to 300 mm). To meet this requirement, the centerline of the sprinkler waterway must be located 4-7/16 to 12-7/16 inches (112,7 to 315,9 mm) below the ceiling (Ref. Figure 7).

Operation

In standby condition, the unique assembly of RAVEN Institutional Pendent and Horizontal Sidewall Sprinklers is designed with tamper-resistant features to help prohibit a false activation and help reduce the opportunity for individuals to injure themselves or others with components of a fire sprinkler. RAVEN Institutional Sprinklers are specifically designed to minimize components, as well as holes or shapes, that could provide a point for securing an external non-sprinkler associated object. Also, when properly installed, the escutcheon is held fast to the ceiling or wall to deter its removal. The shape of the sprinkler and escutcheon cannot be grasped easily, which further deters tampering.

For information on the break-away load of RAVEN Institutional Sprinklers, contact Technical Services.

A link assembly covers the sealing assembly. The link is soldered with an eutectic solder that melts when exposed to heat. When the link reaches its rated temperature, the link separates and releases the sealing assembly, allowing the deflector assembly to extend from the body and water to flow.

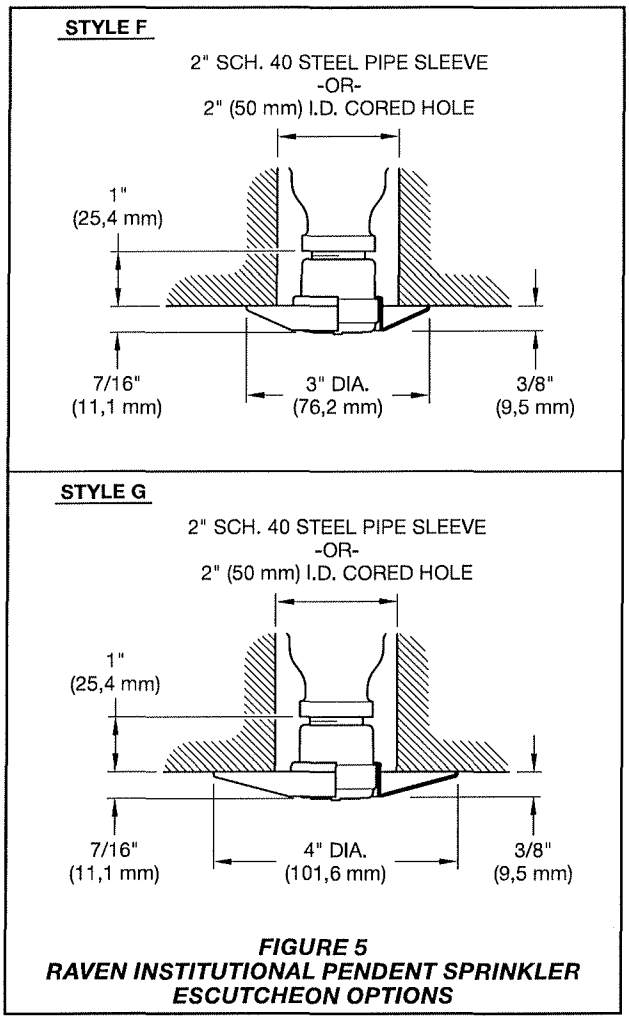


FIGURE 5
RAVEN INSTITUTIONAL PENDENT SPRINKLER ESCUTCHEON OPTIONS

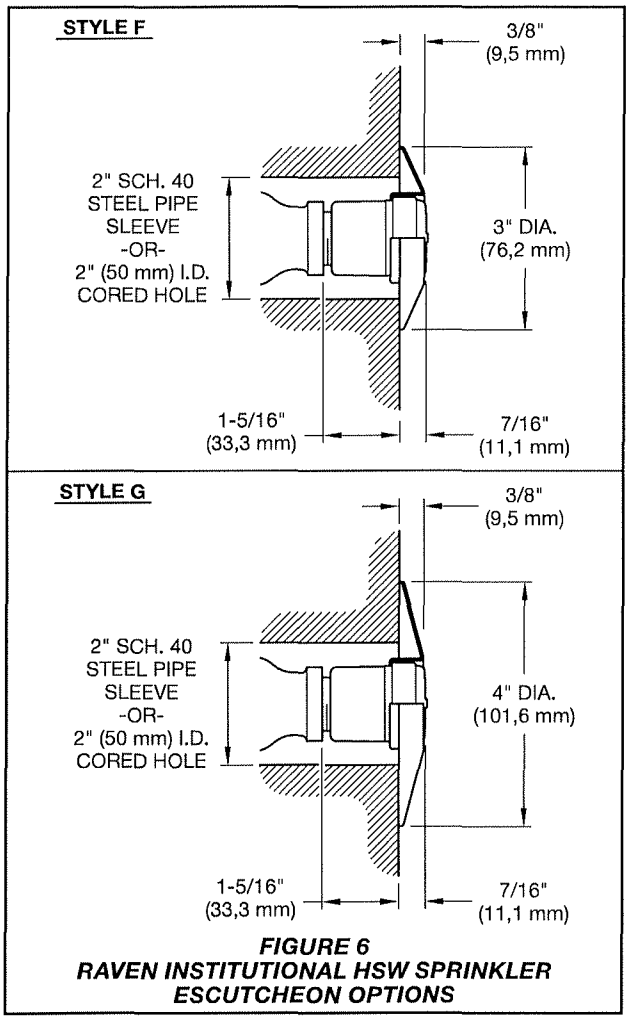


FIGURE 6
RAVEN INSTITUTIONAL HSW SPRINKLER ESCUTCHEON OPTIONS

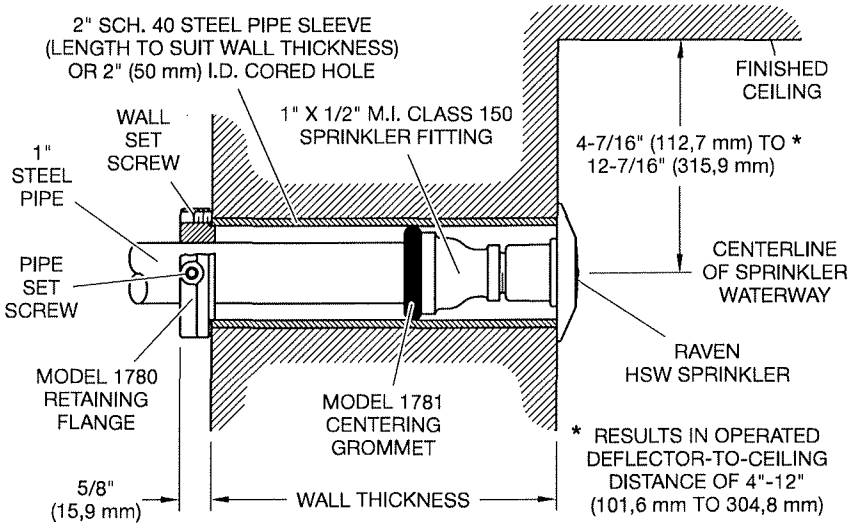


FIGURE 7
MODEL 1780 RETAINING FLANGE AND MODEL 1781 CENTERING GROMMET HORIZONTAL INSTALLATION FOR PENDENT

Installation

TYCO RAVEN 5.6K Institutional Pendent and Horizontal Sidewall Sprinklers must be installed in accordance with this section.

General Instructions
Integrity of the tamper-resistant design of RAVEN Escutcheons is dependent on the piping installation design. When installed properly, the escutcheon is held fast (i.e., tight with no movement or gap) to the mounting surface (ceiling or wall, as applicable) by tightening the sprinkler assembly into the sprinkler fitting. Be careful not to create too much force between the escutcheon and wall, as extensive force may cause issues with the pulling of the sprinkler body from the stem, possibly causing warping, cracks, and leaks.

A tamper-resistant installation requires all of the following:

- The sprinkler fitting must be properly located with respect to distance from the face of the sprinkler fitting to the face of the mounting surface (Ref. Figures 5 & 6).
- The sprinkler fitting must be rigidly secured and immobile through the use of the retaining flange, installed flush to the back of the wall or above the ceiling and secured with the pipe set screws.
- The centerline of the sprinkler fitting must be perpendicular to the mounting surface to assure that the Institutional Escutcheon sits squarely against the mounting surface around its entire perimeter.

Figure 7 illustrates a technique to adjust the location of the sprinkler fitting to help assure immobility of the sprinkler fitting and to help maintain perpendicularity of the sprinkler fitting to the mounting surface.

While Figure 7 illustrates a horizontal installation, it can be applied to pendent installations.

When applied, the technique shown in Figure 7 allows the sprinkler/supply pipe to be pulled back into the mounting surface from behind the wall or above the ceiling, and the retaining flange set flush to the back of the wall or above the ceiling and secured with the retaining flange pipe set screws. This technique will help overcome problems with assuring that the escutcheon is held fast to the mounting surface (i.e., tight with no movement or gap).

It is recommended that flexible sprinkler piping is used to connect the sprinkler pipe to the supply piping to maximize installation flexibility and to ensure that the sprinkler and the escutcheon are installed properly, as shown in Figure 7.

A 1/2 inch NPT sprinkler joint should be obtained by applying a minimum-to-maximum torque of 7 to 14 lbs.-ft. (9,5 to 19,0 Nm). Higher levels of torque may damage the sprinkler with consequent leakage or impairment of the sprinkler. Rather than over-torquing to meet proper orientation for the horizontal sidewall sprinkler, stop tightening earlier.

Do not attempt to compensate for improper location of the sprinkler fitting by under- or over-tightening the sprinkler.

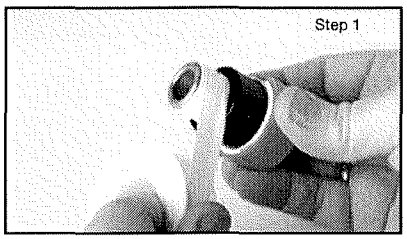
After installation is complete, ensure the RAVEN Escutcheon is held fast (i.e., tight with no movement or gap) to the mounting surface and that the escutcheon sits squarely against the mounting surface around its entire perimeter.

The following tools are recommended for proper installation of RAVEN Institutional Sprinklers:

- TEFLON tape
- TYCO W-Type 25 Installation Wrench
- 1/2 inch drive ratchet wrench
- Torque wrenches
- Ratchet extension (optional)
- Level

NOTICE

Install RAVEN Pendent Sprinklers with the centerline of the waterway perpendicular to the ceiling. Install RAVEN Horizontal Sidewall sprinklers with the centerline of their waterway parallel with the ceiling and perpendicular to the back wall.



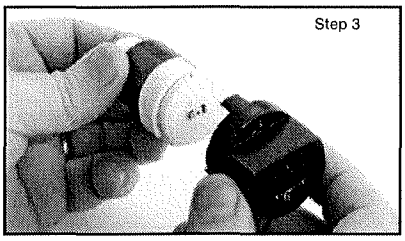
Step 1. Inspect the sprinkler for any visible signs of damage that could have occurred during shipping or handling.

Apply a non-hardening pipe-thread sealant such as TEFLON tape to the NPT thread of the sprinkler. Applying between two (2) and four (4) full wraps of tape is recommended.

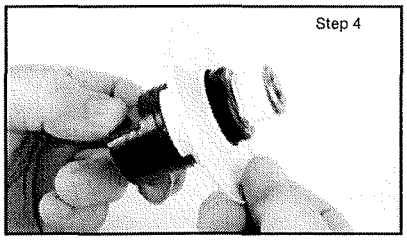
Carefully remove the orange protective cap from the sprinkler by pulling it straight out without bending it.

Verify that the sprinkler identification number (SIN) and temperature rating located on the side of the sprinkler match installation requirements.

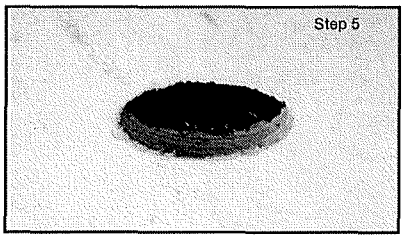
Step 2. Align the TYCO W-Type 25 Installation Wrench with the sprinkler. The flat surface should be in line with the small colored dot on the sprinkler.



Step 3. Ensure that the TYCO W-Type 25 Installation Wrench is fully engaged onto the sprinkler. Fully insert all three Wrench Prongs into the slots on the sprinkler body.



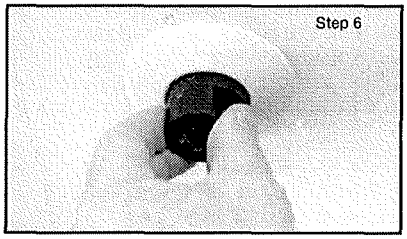
Step 4. With the Wrench on the sprinkler, place the escutcheon over the sprinkler.



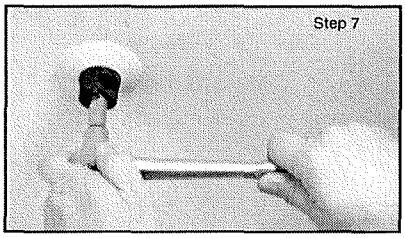
Step 5. Ensure that the ceiling/wall is smooth for the escutcheon to sit against and that the distance from the ceiling/wall surface to the sprinkler fitting is appropriate. As shown in Figures 5 and 6, the take-out dimensions are 1 inch for pendent sprinklers and 1-5/16 inches for horizontal sidewall sprinklers.

NOTICE

The sprinkler has intentionally been designed to be difficult to grasp by hand. Therefore, the use of the W-Type 25 Installation Wrench for hand-tightening assists in threading the sprinkler. Also, use of the W-Type 25 Installation Wrench helps avoid damage to the sprinkler during installation.



Step 6. With the escutcheon in place and with pipe-thread sealant applied to the pipe threads, hand-tighten the sprinkler into the sprinkler fitting using the TYCO W-Type 25 Installation Wrench with the wrench prongs fully engaged with the sprinkler wrenching notches. The wrench prongs are designed to engage the wrenching notches in the sprinkler body, and are also uniquely spaced to align with the sprinkler wrenching notches in one position.



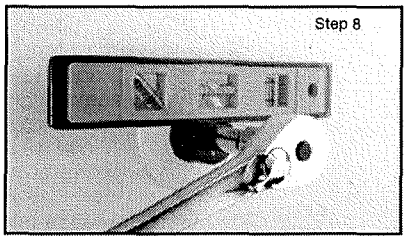
Step 7. Wrench-tighten the sprinkler using only the TYCO W-Type 25 Installation Wrench (Ref. Figure 3).

Insert a 1/2 inch drive ratchet wrench (with or without the extension) into the TYCO W-Type 25 Installation Wrench. Ensure the ratchet wrench remains parallel to the ceiling/wall. A ratchet extension can help to keep the wrench in line with the sprinkler. Torque for the RAVEN Institutional Sprinkler is 7 to 14 lbs.-ft.

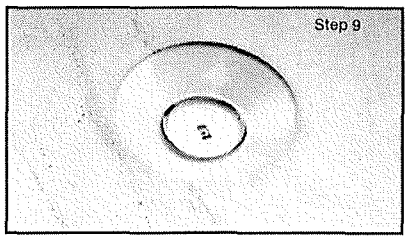
NOTICE

To help prevent slippage of the wrench and while using a 1/2 inch drive ratchet wrench, place one hand over the TYCO W-Type 25 Installation Wrench while tightening with the other hand.

A recommended technique to determine if the torque range is achieved involves the use of two different torque wrenches. Adjust first with a 7 ft.-lbs. torque wrench, followed by adjusting with a 14 ft.-lbs. wrench.



Step 8. For horizontal sidewall sprinklers, a Level can be placed on top of the flat surface of the TYCO W-Type 25 Installation Wrench to orient the sprinkler correctly.



Step 9. After installation is complete, ensure that the RAVEN Escutcheon is held fast against the mounting surface and sits squarely against the ceiling around its entire perimeter.

When applied, the technique shown in Figure 7 allows the sprinkler/supply pipe to be pulled back into the mounting surface from behind the wall or above the ceiling, and the retaining flange set flush to the back of the wall or above the ceiling and secured with the retaining flange pipe set screws. Do not over-tighten the wall set screws, as over-tightening these screws may damage the sprinkler.

To verify correct sprinkler application, refer to the Notes in Figures 3 and 4 on SIN color dot indicators.

For horizontal sidewall sprinklers, the SIN color dot also helps verify deflector orientation. In proper installations of RAVEN Horizontal Sidewall Sprinklers, SIN color dots face up.

NOTICE

If the escutcheon is not held fast (i.e., tight with no movement or gap) to the mounting surface and as an option to relocating the sprinkler fitting (increasing the face-of-fitting to face-of-mounting surface distance), up to two (2) Adjustment Spacer Rings as shown in Figure 3 may be utilized. Each Adjustment Spacer Ring can account for 0.075 inches of gap between the escutcheon and mounting surface. Therefore, if the gap is greater than 0.150 inches, the sprinkler fitting will need to be relocated to assure proper installation of both the sprinkler and escutcheon.

Care and Maintenance

TYCO RAVEN 5.6K Institutional Pendent and Horizontal Sidewall Sprinklers must be maintained and serviced in accordance with this section.

Before closing a fire protection system main control valve for maintenance work on the fire protection system that it controls, obtain permission to shut down the affected fire protection system from the proper authorities and notify all personnel who may be affected by this action.

Service inspections should be made on a regular basis to detect possible damage or alterations to the sprinkler and escutcheon. Inspections should include making certain that the RAVEN Institutional Escutcheon is held fast to the mounting surface. Damaged or altered sprinklers are to be replaced immediately to avoid personal injury and to prevent use for causing personal injury, as well as to maintain the sprinkler system in an operative condition.

Sprinklers which are found to be leaking or exhibiting visible signs of corrosion must be replaced.

Automatic sprinklers must never be painted, plated, coated, or otherwise altered after leaving the factory. Modified sprinklers must be replaced. Sprinklers that have been exposed to corrosive products of combustion, but have not operated, should be replaced if they cannot be completely cleaned by wiping the sprinkler with a cloth or by brushing it with a soft bristle brush.

Care must be exercised to avoid damage to the sprinklers before, during, and after installation. Sprinklers damaged by dropping, striking, wrench twist/slippage, or the like, must be replaced. Also, replace any sprinkler that has a cracked bulb or that has lost liquid from its bulb (Ref. Installation section).

Frequent visual inspections are recommended to be initially performed for sprinklers installed in potentially corrosive atmospheres to verify the integrity of the materials of construction as they may be affected by the corrosive conditions present for a given installation. Thereafter, annual inspections per NFPA 25 are required.

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the National Fire Protection Association (e.g., NFPA 25), in addition to the standards of any other authorities having jurisdiction. Contact the installing contractor or product manufacturer regarding any questions.

Sprinklers are recommended to be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.

Limited Warranty

For warranty terms and conditions, visit www.tyco-fire.com.

Disclaimer for RAVEN Institutional Sprinklers

TYCO Fire Protection Products specifically disclaims any liability for damages or injury (including death) arising out of or caused by manipulation, dismantling, or misuse of RAVEN Institutional Sprinklers or the use or attempted use of the RAVEN Institutional Sprinklers or any component thereof as an instrument unrelated to its intended function as a fire protection device.

Ordering Procedure

Contact your local distributor for availability. When placing an order, indicate the full product description and part number (P/N).

Sprinkler Assemblies
Specify: RAVEN (Standard or Extended Coverage), 165°F (74°C), Institutional (Pendent or Horizontal Sidewall) Sprinkler with (specify) Finish, and P/N (specify):

Standard Coverage Pendent (TY3281)
White . . . . . P/N 50-314-4-165
Grey . . . . . P/N 50-314-9-165

Standard Coverage HSW (TY3381)
White . . . . . P/N 50-316-4-165
Grey . . . . . P/N 50-316-9-165

Extended Coverage Pendent (TY3282)
White . . . . . P/N 50-315-4-165
Grey . . . . . P/N 50-315-9-165

Extended Coverage HSW (TY3382)
White . . . . . P/N 50-317-4-165
Grey . . . . . P/N 50-317-9-165

Separately Ordered Escutcheons Style F (3" Diameter)

Carbon Steel
White . . . . . P/N 56-314-4-010
Grey . . . . . P/N 56-314-7-010
Chrome Coated . . . . . P/N 56-314-9-010

Stainless Steel
White . . . . . P/N 56-318-4-010
Grey . . . . . P/N 56-318-7-010
Electropolished* . . . . . P/N 56-318-9-010

Separately Ordered Escutcheons Style G (4" Diameter)

Carbon Steel
White . . . . . P/N 56-312-4-010
Grey . . . . . P/N 56-312-7-010
Chrome Coated . . . . . P/N 56-312-9-010

Stainless Steel
White . . . . . P/N 56-319-4-010
Grey . . . . . P/N 56-319-7-010
Electropolished* . . . . . P/N 56-319-9-010

* Chrome-coated appearance

Separately Ordered Sprinkler Wrench
Specify: W-Type 25 Installation Wrench, P/N 56-314-1-001

Separately Ordered Parts for Installation in Concrete
Specify: Model 1781 Centering Grommet for installation in concrete, P/N 56-000-1-781

Specify: Model 1780 Retaining Flange with Set Screws for installation in concrete, P/N 56-000-1-780

Separately Ordered Adjustment Spacer Ring
Specify: Adjustment Spacer Ring for use with RAVEN Institutional Sprinklers, P/N 56-000-1-755

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tyco Fire Protection Products

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Permit #*2016-1214775-CT*

Schedule 40 - Hydraulic Tables

FM Approved and UL Listed Sprinkler Pipe

Schedule 40 Pipe

NOMINAL PIPE SIZE (in)	O.D. (in)	I.D. (in)	WEIGHT (lbs/ft)	BUNDLE SIZE
1	1.315	1.049	1.68	70
1 1/4	1.660	1.380	2.27	51
1 1/2	1.900	1.610	2.72	44
2	2.375	2.067	3.66	30
2 1/2	2.875	2.468	5.80	30
3	3.500	3.068	7.58	19
4	4.500	4.026	10.80	19

Any questions or comments should be addressed to Bull Moose Tube Technical Support Department at 888-227-5430, or via e-mail at techsupport@bullmoosetube.com. Please request our cutsheet for more information on Schedule 40.

Friction loss calculations are based on the Hazen-Williams formula

$P = (4.52 \times Q^{1.85}) / (C^{1.85} \times d^{4.87})$, Where

P is the frictional resistance in pounds pressure per square inch per foot of pipe,
Q is the gallons per minute flowing,
d is the inside diameter of pipe in inches, and
C is the friction loss coefficient. C=100 (for dry systems), C= 120 (for wet systems).
I.D.'s used for the calculations are given in parenthesis.

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FAX: (636) 537-2645
www.bullmoosetube.com
e-mail: sales@bullmoosetube.com

For additional information, contact your salesperson today at (800) 325-4467 or (636) 537-2600 in the USA, or from Canada call (800) 882-4666

c UL us LISTED
FM APPROVED

All information contained herein is accurate as known at the time of publication. Bull Moose Tube reserves the right to change product specifications without notice and without incurring obligation.

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Pipe Fittings & Steel Nipples

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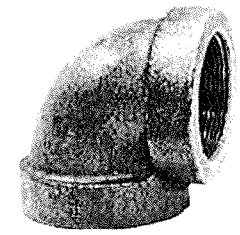
NOVEMBER 2013
For the most current product/pricing information on Anvil products, please visit our website at **www.anvilintl.com**

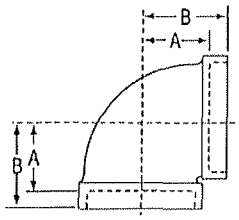
RSN: 1167877
Permit #2016-1214775-CT

Cast Iron Threaded Fittings

Class 125 (Standard)

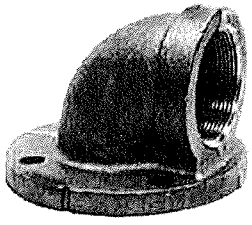
FIGURE 351
90° Elbow

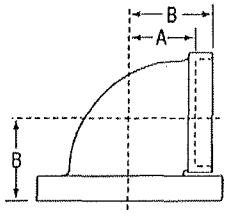




Size		A		B		Unit Weight Black	
NPS	DN	in	mm	in	mm	lbs	kg
1/4	8	1/2	13	13/16	22	0.16	0.07
3/8	10	9/16	14	15/16	24	0.25	0.11
1/2	15	11/16	17	1 1/8	29	0.40	0.18
3/4	20	13/16	22	1 15/16	33	0.60	0.27
1	25	15/16	24	1 1/2	38	0.92	0.42
1 1/4	32	1 1/8	29	1 3/4	44	1.44	0.65
1 1/2	40	1 5/16	33	1 15/16	49	1.95	0.88
2	50	1 9/16	40	2 1/4	57	3.13	1.42
2 1/2	65	1 13/16	47	2 11/16	68	4.94	2.24
3	80	2 3/16	56	3 1/8	79	7.21	3.27
3 1/2	90	2 7/16	62	3 7/16	87	9.67	4.39
4	100	2 11/16	68	3 13/16	98	12.17	5.52
5	125	3 5/16	84	4 1/2	114	21.46	9.73
6	150	3 7/8	98	5 1/8	130	31.33	14.21
8	200	5 3/16	132	6 9/16	167	64.56	29.28

FIGURE 371
90° Elbow,
Flange & Screw





Size		A		B		Unit Weight Black	
NPS	DN	in	mm	in	mm	lbs	kg
2 1/2	65	1 13/16	47	2 11/16	68	10.22	4.63
3	80	2 3/16	56	3 1/8	79	13.25	6.01
4	100	2 11/16	68	3 13/16	98	21.56	9.78
6	150	3 7/8	98	5 1/8	130	40.50	18.37

†Nominal Pipe Sizes of 4" (100 DN) and larger have two holes tapped for stud or tap bolts.

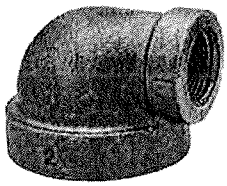
Note: See page 36 for pressure-temperature ratings.

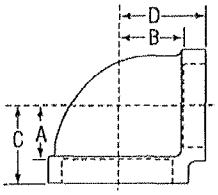
RSN: 1167877
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Cast Iron Threaded Fittings

Class 125 (Standard)

FIGURE 352
90° Elbow, Reducing





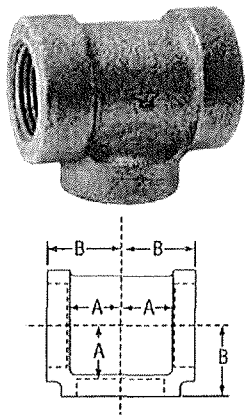
Size				A		B		C		D		Unit Weight Black	
NPS	DN	NPS	DN	in	mm	in	mm	in	mm	in	mm	lbs	kg
1/2	15	1/4	8	5/8	16	3/4	19	1 1/16	27	1 1/16	27	0.40	0.18
		3/8	10	5/8	16	11/16	17	1 1/16	27	1 1/16	27	0.34	0.15
3/4	20	1/2	15	11/16	17	13/16	22	1 1/4	32	1 1/4	32	0.51	0.23
1	25	1/2	15	11/16	17	15/16	24	1 3/8	35	1 3/8	35	0.67	0.30
		3/4	20	13/16	22	15/16	24	1 7/16	37	1 7/16	37	0.76	0.34
1 1/4	32	1/2	15	11/16	17	1 1/16	27	1 1/2	38	1 1/2	38	1.07	0.49
		3/4	20	13/16	22	1 1/8	29	1 5/8	41	1 5/8	41	1.02	0.46
		1	25	15/16	24	1 1/8	29	1 11/16	43	1 11/16	43	1.21	0.55
1 1/2	40	1/2	15	3/4	19	1 1/4	32	1 5/8	41	1 5/8	41	1.53	0.69
		3/4	20	7/8	22	1 5/16	33	1 13/16	47	1 13/16	47	1.55	0.70
		1	25	1	25	1 1/4	32	1 13/16	47	1 13/16	47	1.44	0.65
		1 1/4	32	1 3/16	30	1 1/4	32	1 7/8	48	1 7/8	48	1.74	0.79
2	50	1/2	15	1 3/16	30	1 7/16	37	1 3/8	35	1 3/8	35	2.22	1.01
		3/4	20	1 5/16	33	1 1/2	38	2	51	2	51	2.20	1.00
		1	25	1 1/16	27	1 7/16	37	2	51	2	51	2.08	0.94
		1 1/4	32	1 3/16	30	1 7/16	37	2 1/16	52	2 1/16	52	2.33	1.06
		1 1/2	40	1 5/16	33	1 1/2	38	2 1/8	54	2 1/8	54	2.59	1.17
2 1/2	65	1	25	1	25	1 3/4	44	2 5/16	59	2 5/16	59	2.93	1.33
		1 1/4	32	1 3/16	30	1 3/4	44	2 3/8	60	2 3/8	60	3.41	1.55
		1 1/2	40	1 5/16	33	1 13/16	47	2 7/16	62	2 7/16	62	3.68	1.67
		2	50	1 9/16	40	1 7/8	48	2 9/16	65	2 9/16	65	4.01	1.82
3	80	1 1/4	32	1 5/8	41	2 5/16	59	2 15/16	75	2 15/16	75	5.98	2.71
		1 1/2	40	1 5/8	41	2 5/16	59	2 15/16	75	2 15/16	75	5.65	2.56
		2	50	1 5/8	41	2 1/4	57	2 15/16	75	2 15/16	75	5.25	2.38
		2 1/2	65	1 7/8	48	2 3/16	56	3 1/16	78	3 1/16	78	6.44	2.92
4	100	2	50	2 3/16	56	2 15/16	75	3 5/8	92	3 5/8	92	11.89	5.39
		2 1/2	65	2 3/16	56	2 3/4	70	3 5/8	92	3 5/8	92	11.27	5.11
		3	80	2 3/16	56	2 11/16	68	3 5/8	92	3 5/8	92	10.63	4.82
5	125	4	100	2 13/16	73	3 5/16	84	4 3/8	111	4 3/8	111	16.47	7.47
6	150	3	80	2 5/16	59	3 13/16	98	4 13/16	124	4 13/16	124	19.43	8.81
		4	100	2 13/16	73	3 7/8	98	4 15/16	125	4 15/16	125	23.53	10.67
		5	125	3 3/8	86	3 13/16	98	5	127	5	127	26.66	12.09

Note: See page 36 for pressure-temperature ratings.

Cast Iron Threaded Fittings

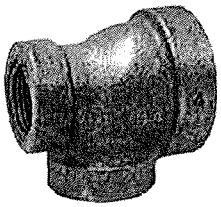
Class 125 (Standard)

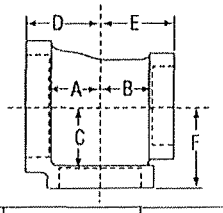
FIGURE 358
Tee



Size		A		B		Unit Weight Black	
NPS	DN	in	mm	in	mm	lbs	kg
1/4	8	1/2	13	13/16	22	0.22	0.10
3/8	10	5/8	16	1	25	0.35	0.16
1/2	15	11/16	17	1 1/8	29	0.56	0.25
3/4	20	13/16	22	1 5/16	33	0.84	0.38
1	25	15/16	24	1 1/2	38	1.25	0.57
1 1/4	32	1 1/8	29	1 3/4	44	2.03	0.92
1 1/2	40	1 5/16	33	1 15/16	49	2.70	1.22
2	50	1 9/16	40	2 1/4	57	4.23	1.92
2 1/2	65	1 13/16	47	2 11/16	68	6.67	3.02
3	80	2 3/16	56	3 1/8	79	10.00	4.54
3 1/2	90	2 7/16	62	3 7/16	87	13.29	6.03
4	100	2 11/16	68	3 3/4	95	16.33	7.41
5	125	3 5/16	84	4 1/2	114	27.33	12.39
6	150	3 7/8	98	5 1/8	130	40.85	18.53
8	200	5 3/16	132	6 9/16	167	79.00	35.83

FIGURE 359
Tee Reducing





Size						A		B		C		D		E		F		Unit Weight Black	
NPS	DN	NPS	DN	NPS	DN	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	lbs	kg
1/2	15	1/2	15	1/4	8	1 1/16	17	11/16	17	13/16	22	1 1/8	29	1 1/8	29	1 1/8	29	0.57	0.26
				3/8	10	1 1/16	17	11/16	17	3/4	19	1 1/8	29	1 1/8	29	1 1/8	29	0.57	0.26
				3/4	20	1 3/16	22	13/16	22	11/16	17	1 1/4	32	1 1/4	32	13/16	22	0.68	0.31
				1	25	1	25	1	25	13/16	22	1 7/16	37	1 7/16	37	1 3/8	35	1.00	0.45
3/4	20	1/4	8	3/4	20	1 3/16	22	15/16	24	13/16	22	15/16	24	1 1/4	32	15/16	24	0.79	0.36
		1/2	15	1/2	15	1 1/16	17	11/16	17	13/16	22	13/16	22	1 1/8	29	1 1/4	32	0.64	0.29
				3/4	20	1 3/16	22	13/16	22	13/16	22	15/16	24	1 1/4	32	15/16	24	0.75	0.34
		3/4	20	1/4	8	9/16	14	9/16	14	7/8	22	11/16	17	11/16	17	13/16	22	0.62	0.28
				3/8	10	1 1/16	17	11/16	17	15/16	24	13/16	22	13/16	22	1 1/4	32	0.75	0.34
				1/2	15	1 1/16	17	11/16	17	13/16	22	13/16	22	13/16	22	1 1/4	32	0.76	0.34
				1	25	1 5/16	24	15/16	24	13/16	22	1 7/16	37	1 7/16	37	1 3/8	35	0.99	0.45
1	25	1/4	8	1	25	1 5/16	24	15/16	24	15/16	24	1 1/2	38	1 1/4	32	1 1/2	38	1.08	0.49
		1/2	15	1/2	15	1 1/16	17	3/4	19	15/16	24	1 1/4	32	13/16	22	1 3/8	35	0.90	0.41
				3/4	20	1 3/16	22	13/16	22	15/16	24	1 3/8	35	1 1/4	32	1 7/16	37	0.91	0.41
				1	25	1 5/16	24	15/16	24	15/16	24	1 1/2	38	1 3/8	35	1 1/2	38	1.08	0.49
		3/4	20	1/2	15	1 1/16	17	11/16	17	15/16	24	1 1/4	32	13/16	22	1 3/8	35	0.89	0.40
				3/4	20	1 3/16	22	13/16	22	15/16	24	1 3/8	35	15/16	24	1 7/16	37	1.00	0.45
				1	25	1 5/16	24	15/16	24	15/16	24	1 1/2	38	1 7/16	37	1 1/2	38	1.13	0.51
		1	25	1/4	8	1 1/16	17	11/16	17	1 1/8	29	1 1/8	29	1 1/4	32	1 3/8	35	1.01	0.46
				1/2	15	1 1/16	17	11/16	17	15/16	24	1 1/4	32	1 1/4	32	1 3/8	35	1.01	0.46
				3/4	20	1 3/16	22	13/16	22	15/16	24	1 3/8	35	1 3/8	35	1 7/16	37	1.11	0.50
				1 1/4	32	1 1/8	29	1 1/8	29	15/16	24	1 11/16	43	1 11/16	43	1 9/16	40	1.49	0.68
				1 1/2	40	1 1/4	32	1 1/4	32	1	25	1 13/16	47	1 13/16	47	1 5/8	41	1.84	0.83
				2	50	1 7/16	37	1 7/16	37	1	25	2	50	2	50	1 3/4	44	2.70	1.22

Note: See page 36 for pressure-temperature ratings.

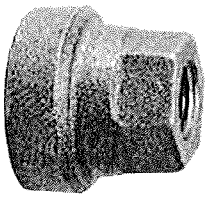
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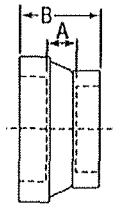
RSN: 1167877
Permit #2016-1214775-CT

Cast Iron Threaded Fittings

Class 125 (Standard)

FIGURE 367
Concentric Reducer





Size				A		B		Unit Weight Black	
NPS	DN	NPS	DN	in	mm	in	mm	lbs	kg
3/4	20	1/2	15	5/8	16	1 9/16	40	0.40	0.18
1	25	1/2 (Hex)	15	11/16	17	1 11/16	43	0.54	0.24
		3/4 (Hex)	20	7/16	11	1 1/2	38	0.63	0.29
1 1/4	32	1/2	15	9/16	14	1 5/8	41	0.84	0.38
		3/4	20	1	25	2 1/8	54	0.90	0.41
		1	25	15/16	24	2 1/8	54	1.07	0.49
1 1/2	40	1/2	15	1/2	13	1 5/8	41	1.00	0.45
		3/4	20	1/2	13	1 5/8	41	1.20	0.54
		1	25	1/2	13	1 3/4	44	1.50	0.68
		1 1/4	32	1	25	2 1/4	57	1.45	0.66
2	50	1/2	15	5/8	16	2	51	2.00	0.91
		3/4	20	3/4	19	2	51	1.90	0.86
		1	25	3/4	19	2	51	1.83	0.83
		1 1/4	32	13/16	22	2 1/8	54	1.78	0.81
		1 1/2	40	7/8	22	2 3/16	56	1.98	0.90
2 1/2	65	1 1/2	40	3/4	19	2	51	3.10	1.41
		2	50	1	25	2 9/16	65	2.98	1.35
3	80	3/4	20	15/16	24	2 1/2	64	4.31	1.95
		2	50	1 1/16	27	2 3/4	70	3.96	1.80
		2 1/2	65	15/16	24	2 13/16	73	4.40	2.00
4	100	2	50	1 3/16	30	2 15/16	75	6.50	2.95
		2 1/2	65	1 3/16	30	3 1/8	79	7.78	3.53
		3	80	1 1/16	27	3 1/8	79	7.01	3.18
5	125	4	100	1 1/16	27	3 5/16	84	10.48	4.75
6	150	4	100	1 1/8	29	3 7/16	87	13.83	6.27
		5	125	1 1/8	29	3 9/16	90	15.53	7.04
8	200	6	150	1 1/4	32	3 7/8	98	29.10	13.20

Note: See page 36 for pressure-temperature ratings.

RSN: 1167877
Permit #2016-1214775-CT

HANGER RODS

ANVIL INTERNATIONAL

Fig. 146

Continuous Threaded Rod

Size Range: 1/4" through 1 1/2" Stocked in six, ten, and twelve foot lengths. Other even foot lengths can be furnished to order.
Material: Carbon steel or Stainless Steel Gr 304
Threads: National Coarse (USS), rod threaded complete length.
Finish: ☐ Plain or ☐ Galvanized.
Maximum Temperature: 650° F.
Ordering: Specify rod diameter and length, figure number, name and finish.
Note: The acceptability of galvanized coatings at temperatures above 450°F is at the discretion of the end user.



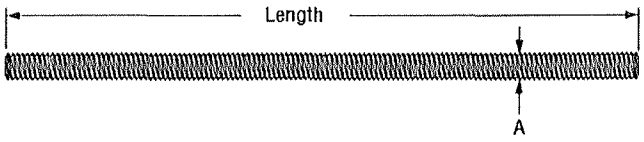


FIG. 146:
LOADS (LBS) • WEIGHTS (LBS) • DIMENSIONS (IN)

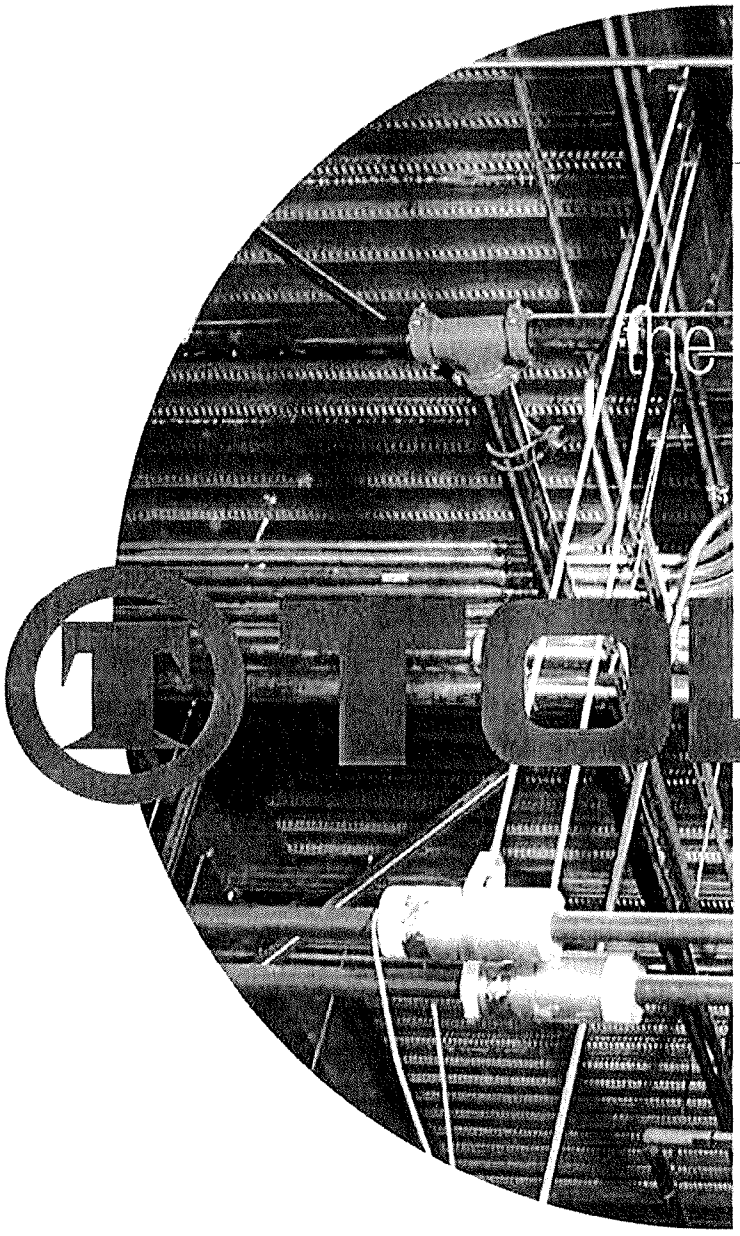
Rod Size A	Threads per Inch	Max Load 650° F	Weight per Ft.
1/4	20	240	0.12
3/8	16	730	0.30
1/2	13	1,350	0.53
5/8	11	2,160	0.84
3/4	10	3,230	1.20
7/8	9	4,480	1.70
1	8	5,900	2.30
1 1/4	7	9,500	3.60
1 1/2	6	13,800	5.10

Note: Other rod sizes available upon request. Class 2 fit is available upon request.

PROJECT INFORMATION	APPROVAL STAMP
Project:	☐ Approved
Address:	☐ Approved as noted
Contractor:	☐ Not approved
Engineer:	Remarks:
Submittal Date:	
Notes 1:	
Notes 2:	

RSN: *1167877*
Permit #*2016-1214775-CT*

TOLCO™ Fire Protection Support Systems



Supporting the Flow.™

TOLCO™

Pipe Hangers
Supports
Seismic Bracing

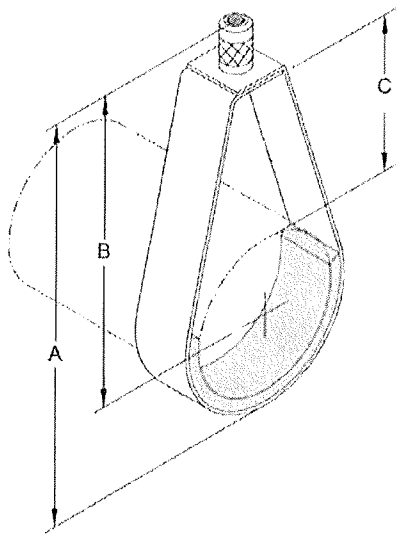
UL Listed
for Fire Sprinkler
Installations

TOLCO™ is a brand of NIBCO

Fig. 2F - Adjustable Band Hanger with Felt Lining

c UL us LISTED

Size Range — 1/2" thru 6" copper tubing
Material — Carbon Steel, Pre-Galvanized
Function — Recommended for the suspension of copper tube so as to prevent electrolysis. The felt lining also acts to reduce noise in copper or other pipe types.
Approvals — Underwriters' Laboratories Listed in the USA **(UL)** and Canada **(cUL)**. Conforms to Federal Specification WW-H-171E, Type 10 and Manufacturers Standardization Society SP-69, Type 10.
Finish — Pre-Galvanized
Note — When used for steel or other pipe types, consult factory for proper size. Available in Stainless Steel materials.
Order By — Figure number and copper tube size



Dimensions • Weights

Copper Tube Size	Rod Size	A	B	C	Max. Rec. Load Lbs.	Approx. Wt./100
1/2	3/8	3 1/8	2 5/8	1 3/8	400	12
3/4	3/8	3 1/8	2 1/2	1 1/8	400	12
1	3/8	3 3/8	2 5/8	1 1/8	400	13
1 1/4	3/8	3 3/4	2 7/8	1 1/4	400	14
1 1/2	3/8	3 7/8	2 7/8	1 1/8	400	15
2	3/8	4 1/4	3	1	400	16
2 1/2*	1/2	5 3/4	4 1/8	1 3/4	600	41
3*	1/2	6	4	1 1/2	600	46
3 1/2*	1/2	7 3/8	5 1/4	1 3/8	600	53
4*	5/8	7 3/8	5	1 7/8	1000	60
5**	5/8	9	6 1/8	2 1/2	1250	98
6**	3/4	9 3/8	6 1/2	2 1/4	1250	140

* 3/8" nut is used when requested.
** 1/2" nut is used when requested.

Fig. 65 and Fig. 66 - Reversible C-Type Beam Clamps 3/4" and 1¼" Throat Openings

c UL us LISTED
Component of State of California OSHPD Approved Seismic Restraints System

Size Range — (Fig. 65 and Fig. 66) 3/8", 1/2" and 5/8" rod

Material — Carbon Steel with hardened cup point set screw and jam nut

Function — Recommended for hanging from steel beam where flange thickness does not exceed 3/4" (Fig. 65) or 1 1/4" (Fig. 66).

Features — All steel construction eliminates structural deficiencies associated with casting type beam clamps. May be used on top or bottom flange of the beam. (Beveled lip allows hanging from top flange where clearance is limited.) May be installed with set screw in up or down position. Offset design permits unlimited rod adjustment by allowing the rod to be threaded completely through the clamp. Open design permits inspection of thread engagement.

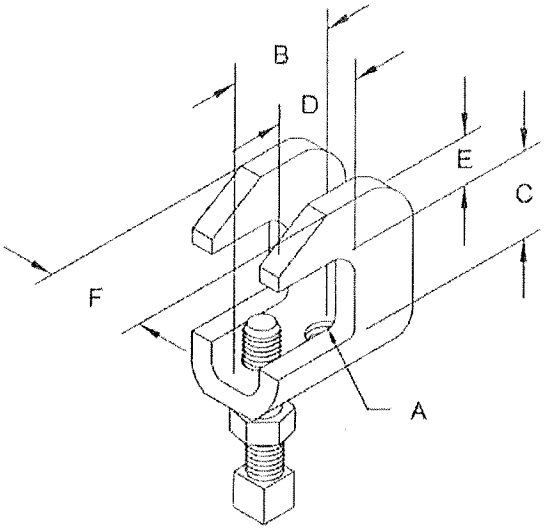
Approvals — Underwriters' Laboratories Listed in the USA **(UL)** and Canada **(cUL)**. Factory Mutual Engineering approved. Conforms to Federal Specification WW-H-171E, Type 23 and Manufacturers Standardization Society SP-69, Type 19. Exceeds requirements of the National Fire Protection Association (NFPA), Pamphlet 13, 3/8" rod will support 1/2" thru 4" pipe, 1/2" rod will support 1/2" thru 8" pipe. Included in our Seismic Restraints Catalog approved by the State of California Office of Statewide Health Planning and Development (OSHPD). For additional load, spacing and placement information relating to OSHPD projects, please refer to the TOLCO Seismic Restraint Systems Guidelines.

Finish — Plain

Note — Available in Electro-Galvanized and HDG finish.

Order By — Figure number, rod size and finish

Fig. 65 Patent #4,570,885



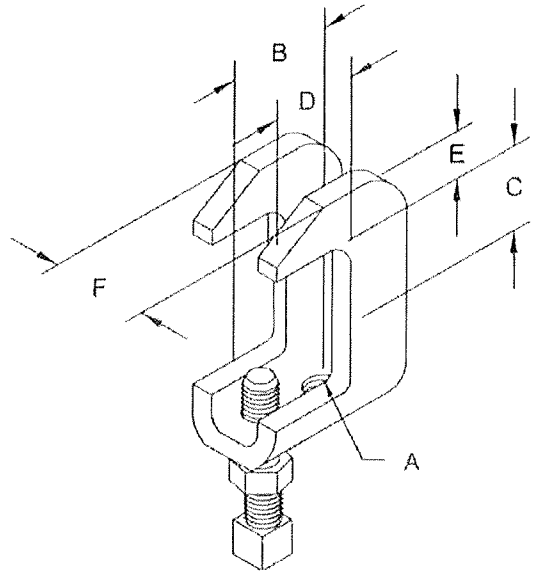


Fig. 65

Dimensions • Weights

Rod Size A	B	C	D	E	F	Max. Rec. Load Lbs.*	Approx. Wt./100
3/8	1 3/16	3/4	1	7/16	1	610	28
1/2	1½	3/4	1	9/16	1¼	1130	55
5/8	1½	3/4	1	9/16	1¼	1130	55

* Max. loads for clamp with set screw in up or down position.

Fig. 66

Dimensions • Weights

Rod Size A	B	C	D	E	F	Max. Rec. Load Lbs.*	Approx. Wt./100
3/8	1 3/16	1¼	1	7/16	1	610	28
1/2	1½	1¼	1	9/16	1¼	1130	55
5/8	1½	1¼	1	9/16	1¼	1130	55

* Max. loads for clamp with set screw in up or down position.

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www.tolco.com

RSN: 1167877
Permit #:2016-1214775-CT

HDI, HDI-L, HDI+ and HDI-L+ Drop-in Anchor 3.3.11

3.3.11.1 Product description
3.3.11.2 Material specifications
3.3.11.3 Technical data
3.3.11.4 Installation instructions
3.3.11.5 Ordering information

3.3.11.1 Product description

HDI+, HDI-L+ and HDI drop-in anchors are internally threaded, flush mounted expansion anchors for use in concrete.

Product features

HDI+, HDI-L+ and HDI

- Anchor, setting tool and Hilti drill bit form a matched tolerance system to provide reliable fastenings
- Allows shallow embedment without sacrificing performance
- Lip allows accurate flush surface setting, independent of hole depth for the HDI-L+
- Ideal for repetitive fastenings with threaded rods of equal length
- HDI+ and HDI-L+ have an innovative stepped plug that reduces number of hammer blows by up to 50%
- HDI+ and HDI-L+ can be installed with the new HDI+ Setting Tool system (stop drill bit and machine setting tool) for improved productivity

Guide specifications

Expansion anchor shall be drop-in, shell or flush type. Carbon steel anchors are zinc plated in accordance with ASTM B633, SC 1, Type III. Stainless steel anchors are manufactured from AISI Type 303 stainless steel. Anchors shall be Hilti HDI+ (HDI-L+) (HDI) anchors as supplied by Hilti.





Listings/Approvals

FM (Factory Mutual)
Pipe Hanger Components for Automatic Sprinkler Systems HDI+ 3/8, HDI-L+ 3/8, HDI+1/2, HDI-L+ 1/2, HDI 5/8 and HDI 3/4

UL LLC
UL 203 Pipe Hanger Equipment for Fire Protection Services HDI+ 3/8, HDI-L+ 3/8, HDI+1/2, HDI-L+ 1/2, HDI 5/8 and HDI 3/4

FM APPROVED c UL us LISTED

3.3.11

3.3.11.2 Material specifications

HDI+, HDI-L+ and HDI anchors are manufactured from mild carbon steel. Anchor bodies are zinc plated in accordance with ASTM B633, SC 1, Type III.

HDI stainless steel anchors are manufactured from AISI Type 303 stainless steel.

3.3.11.3 Technical data

Table 1 - HDI+, HDI-L+ and HDI specifications[1]

Setting Information	Symbol	Units	HDI+ and HDI-L+			HDI	
			1/4	3/8	1/2	5/8	3/4
Insert thread	d	UNC	1/4-20	3/8-16	1/2-13	5/8-11	3/4-10
Nominal bit diameter	d_{bit}	in.	3/8	1/2	5/8	27/32	1
Nominal embedment Anchor length Hole depth	h_{nom} ℓ h_o	in. (mm)	1 (25)	1-9/16 (40)	2 (51)	2-9/16 (65)	3-3/16 (81)
Useable thread length	ℓ_{th}	in. (mm)	7/16 (11)	5/8 (15)	11/16 (17)	7/8 (22)	1-3/8 (34)
Installation torque	T_{inst}	ft-lb (Nm)	4 (5)	11 (15)	22 (30)	37 (50)	80 (109)
Minimum slab thickness	h	in. (mm)	3 (76)	3-1/8 (79)	4 (102)	5-1/8 (130)	6-3/8 (162)

1 HDI+ and HDI-L+ are available in 1/4-, 3/8- and 1/2-in. The HDI is available in 5/8- and 3/4-in.

Combined shear and tension loading

$$\left(\frac{N_d}{N_{rec}}\right)^{5/3} + \left(\frac{V_d}{V_{rec}}\right)^{5/3} \leq 1.0$$