City of Aurora Building Division
Project: *Medical Center of Aurora*
Address: *1501 S POTOMAC ST-3rd Peds*
Occupancy Group: *IBC I-2*
Construction Type: *IBC Type IA-SPK*
RSN: *1166825*
Permit: *2016-1212653-LT*

City of Aurora Building Division
Reviewed for Code Compliance
By: *Ted Caviness*
Date: *November 29, 2016*
2015 INTERNATIONAL CODES & 2014 NEC

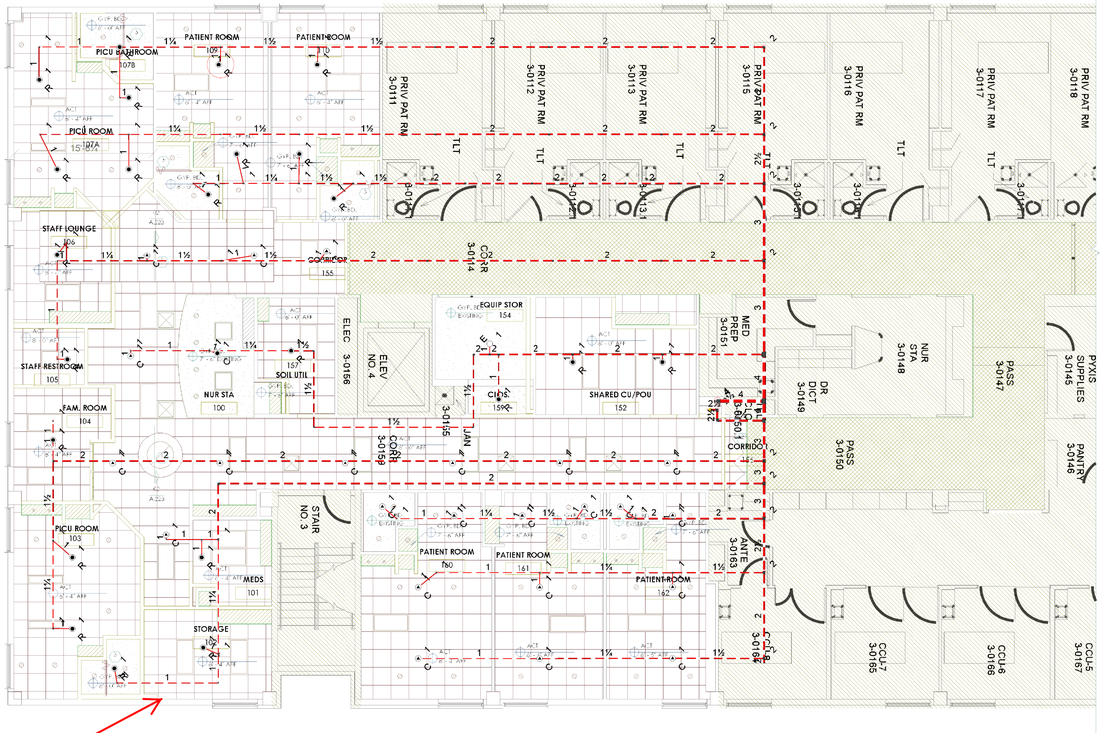
COA Adopted Codes for this project:
ICC-2015 - NEC-2014
NFPA 13-2013 - NFPA 72-2013
COA Amendments 22 & 66

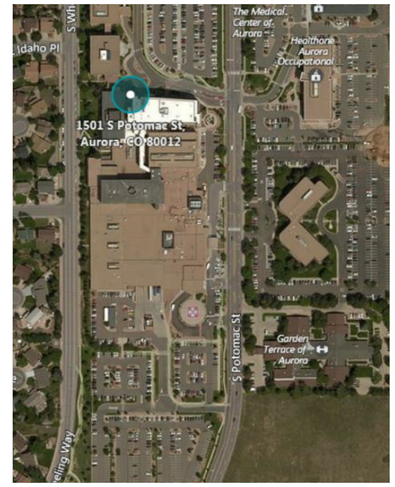
Items determined to be in violation of code during inspection are required to be corrected; this review does not grant approval of code violations.

Deviation from reviewed plans may result in an hourly fee to review the field changes for code compliance.

Field Inspection consultation is available upon request; call (303) 739-7420 to request a consultation.

Special Situations: If a concealed space requiring sprinkler protection, not identifed on the reviewed plans, is deteremined in the field it shall be sprinkler-protected as required by NFPA 13-2013 Section 8.15.

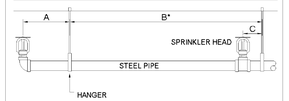




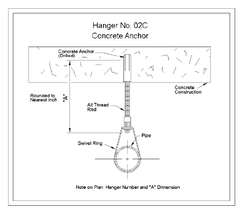
SITE MAP

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



SPRINKLER LEGEND

SIN	ORIF	TEMP	COLOR	COUNT	DESCRIPTION
R3415	1/2"	155°	WHITE	24	RELIABLE G5-56 CONCEALER HEADS
R3415	1/2"	155°	WHITE	23	RELIABLE G5-56 CONCEALER (CHANGE OUT)

24 ✱ RELOCATED QUICK RESPONSE CONCEALER SPRINKLERS

23 C CHANGE OUT TO QUICK RESPONSE CONCEALER (SAME LOCATION)

Field verify room under 130 sqft for protection by one fire sprinkler head.

No more than one fire sprinkler supplied from existing branch fitting without calculations to verify flow (NFPA 13-8.15.20.5)

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. EXISTING OUTLETS IF NOT USED ARE TO BE FILLED WITH PLUGS
8. ALL DROPS AND ARM-OVERS TO BE FIELD FABRICATED.
9. OWNER TO PROVIDE ADEQUATE HEAT TO ALL PLACES WHERE WET SPRINKLER PIPE IS INSTALLED.
10. ALL PAINTING AND WIRING OF DEVICES (IF REQUIRED) TO BE DONE BY OTHERS PER CONTRACT
11. UPON COMPLETION OF THE PROJECT IT IS THE OWNER'S RESPONSIBILITY TO INSPECT, TEST AND MAINTAIN THE SPRINKLER SYSTEM PER NFPA 25

JOHN HULETT
NICET IV #95682
11-18-2016
John Hulett

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

REVISIONS

NO.	DATE	DESCRIPTION	BY	SYMBOL
1	11/17/16			

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

THE MEDICAL CENTER OF AURORA
3RD FLOOR PEDIATRICS
1501 POTOMAC STREET
AURORA, CO 80012

CONTRACT NUMBER
BG5047

3RD FLOOR PEDIATRICS

NORTH

FP-1.0

RSN: ***1166825***
Permit #: ***2016-1212653-LT***

NFPA 13 Sprinkler System Acceptance Inspection

2009 IFC and 2007 NFPA 13

Date of Inspection: _____ Permit Number: _____

Business/Building Name: The Medical Center of Aurora Address of Project: 1501 S POTOMAC ST-3RD FL TOWER A

Contractor: WESTERN STATES FIRE PROTECTION Contractor's Phone: (303) 792-0022

Reference numbers following worksheet statements represent an NFPA code section unless otherwise specified.

	Pass	Fail	NA	
1.	____	____	____	Approved drawing and above-ground piping certification documents are on site.
2.	____	____	____	Underground supply testing and flushing is witnessed and underground piping certification is provided. Flushing requirements shall be 880 GPM for 6 in., 1,560 GPM for 8 in., 2,440 GPM for 10 in., 3,520 for 12 in., have them pitot and calculate that flow and confirm the velocity is at least 10 ft/sec.
3.	____	____	____	Hydrostatic test: wet system, 200 PSI for 2 hours and it should include the FDC piping.
4.	____	____	____	Hydrostatic test: dry and double interlock system: 200 PSI for 2 hours and a 40 PSI air leak test for 24 hours with less than 1.5 PSI loss, 24.2.2.
5.	____	____	____	Back flow prevention device is installed in accordance with the approved set of plans and forward flow tested, 24.2.5.
6.	____	____	____	Systems subject to pressures greater than 150 PSI shall be hydrostatically tested at 50 PSI above system working pressure, 24.2.1.2.
7.	____	____	____	Operational test of the dry-pipe valve is performed and the quick opening device (500+ gallon systems) is tested, 750+ gallon system must trip within 60 seconds.
8.	____	____	____	Pressure reducing valves are tested at maximum and normal inlet pressures or as specified by the manufacturer, the supply pressure is recorded on the certificate, a relief valve is on the discharge side and gauges on each side of the valve, 24.2.4.
Riser				
9.	____	____	____	The main drain is routed to the exterior with a turned down elbow or an inside drain capable of handling the water flow. A flow test is performed. The main drain pipe is ¾ in. or greater for a riser up to 2 in., 1¼ in. or greater for a riser 2½ in. to 3½ in., 2 in. for a riser 4 in. or greater, 8.16.2.4.2, 24.2.3.4.
10.	____	____	____	Water control valves and flow switches are electronically supervised and tested, IFC 903.4.
11.	____	____	____	Paddle-type water flow is not allowed for dry, preaction or deluge systems.
12.	____	____	____	24-hour monitoring service agency or remote supervising station or proprietary supervising station received signals, 903.4.1.
13.	____	____	____	Water flow alarm is tested and initiates an alarm within 5 minutes, located in accordance with the approved set of plans, and it is properly signed, 24.2.3.1.
14.	____	____	____	High-rise: each floor system shall have water flow device with a test connection and be connected to the fire alarm system.
15.	____	____	____	Permanent system identification signs for each control valve and what portion of the building each valve serves is provided, 6.7.4.
16.	____	____	____	A permanent hydraulic nameplate is attached to the riser, 24.5.1. A general information sign that indicates the design capabilities and limitations of the automatic sprinkler system shall be provided at each system riser, antifreeze loop and auxiliary system control valve. The sign shall contain the required information specified in Sections 24.6.2, 24.6.1
17.	____	____	____	Riser is supported by hanger or attachment, for multistory at the lowest level, each alternate level, above and below offsets, and at the top, 9.2.5.4.
18.	____	____	____	Gauges are above and below riser check valve, 7.1.1.2.
FDC				
19.	____	____	____	FDC capped and permanently signed with system type, the required pressure to support the system if the pressure demand is equal to or greater than 150 PSI, and area or building served, 8.17.2.4.7.
20.	____	____	____	FDC has check valve and drip valve, 8.17.2.5.
21.	____	____	____	FDC for wet single riser system connects to the system side, 8.17.2.4.
22.	____	____	____	FDC for wet multiriser system connects after the main system shut off valve, 8.17.2.4.

23. ____ |_____| ____ FDC for dry system connects between the indicating and dry-pipe valves.
24. ____ |_____| ____ FDC pipe complies with the size indicated on the plans, 18 in. to 48 in. above grade, and properly supported, 8.17.2, A.8.17.2. Ensure that the minimum clearance to the sides, front, and height is provided in accordance with IFC 912.3.2.

Sprinklers

25. ____ |_____| ____ Spare sprinklers – Provide at least 6 spare sprinklers for systems designed with 300 or less sprinklers; 12 spare sprinklers for systems designed using 300 to 1,000 sprinklers, and 24 spare sprinklers for systems designed using more than 1,000 sprinklers, 6.2.9.
26. ____ |_____| ____ Replacement wrench(s) are provided, 6.2.9.
27. ____ |_____| ____ Sprinklers shall be a minimum of 4 in. from the wall and be properly spaced, 8.6.3.3.
28. ____ |_____| ____ Sprinkler heads have a guard if subject to damage.
29. ____ |_____| ____ Sprinkler heads are not painted or covered.
30. ____ |_____| ____ ESFR upright deflectors are a minimum 7 in. above the top of the pipe, 8.12.5.3.2.1.
31. ____ |_____| ____ EFSR sprinklers are at least 1 ft. horizontally from the bottom edge of bar joist or open truss and at least 3 ft. above the top of the storage level, 8.12.6.
32. ____ |_____| ____ Proper type and temperature sprinklers are used and match plans.
33. ____ |_____| ____ Escutcheon plates are installed.
34. ____ |_____| ____ Sprinklers are not obstructed, 8.5.5-8.12.5.

Pipe: Hangers, Seismic, and Penetrations

35. ____ |_____| ____ Piping layout and size are the same as on the approved set of plans.
36. ____ |_____| ____ Pipe penetrations have proper clearance 2 in. for pipe 1 in. to 3½ in., 4 in. for pipe 4 in. and larger, 9.3.
37. ____ |_____| ____ When flexible couplings are used in risers, above and below floor penetrations of multistory structures, near penetrations of concrete or masonry walls, and near expansion joints, their location is in accordance with Sections 9.3.2.1– 9.3.2.4
38. ____ |_____| ____ Minimum clearance around pipes penetrating construction elements listed in 9.3.4.1 is in accordance with 9.3.4.2 unless the requirements of 9.3.4.3 – 9.3.4.7 are met.
39. ____ |_____| ____ A seismic separation assembly is provided at building seismic joints, 9.3.3.
40. ____ |_____| ____ Lateral sway bracing is provided and spaced in accordance with the approved set of plans for all mains, cross mains, and branch lines 2½ in. and larger.
41. ____ |_____| ____ Longitudinal sway bracing is provided and spaced in accordance with the approved set of plans for feed mains and cross mains, 9.3.5.4.
42. ____ |_____| ____ A 4-way sway brace is provided at least every 25 ft. and at the top of each riser, 9.3.5.5.
43. ____ |_____| ____ Longitudinal and lateral bracing is provided for each run of pipe between the change of pipe direction unless the pipe run is less than 12 ft., 9.3.5.11.3.
44. ____ |_____| ____ Riser nipples greater than 4 ft. are restrained from lateral movement, 9.3.6.6.
45. ____ |_____| ____ Seismic bracing wire, wrap-around u-hooks, or lateral sway bracing shall not exceed 30 ft. spacing and is used to restrict sprinkler movement that could impact the building, equipment or finishing materials, 9.3.6.
46. ____ |_____| ____ Restraining straps are on all C-clamps and the strap is bolted through if there is not a lip on the beam, 9.3.7.1.
47. ____ |_____| ____ Branch lines have one hanger per section of pipe, 9.2.3.2.
48. ____ |_____| ____ Mains and cross mains have one hanger between each branch line and at the end of the main, 9.2.4.
49. ____ |_____| ____ The maximum distance between the end sprinkler and hanger is 36 in. for 1 in. pipe, 48 in. for 1¼ in., and 60 in. for 1½ in. pipe and greater, 9.2.3.4.
50. ____ |_____| ____ Risers in multistory buildings have supports at the lowest level, at each alternate level, below offsets, and at the top, 9.2.5.4.
51. ____ |_____| ____ Hangers are not within 3 in. of upright sprinklers, 9.2.3.3.

Dry and Preaction Systems

52. ____ |_____| ____ Dry system compressor, fill line, pressure gauges, check valve and shutoff valve and relief valve are installed in accordance with the approved set of plans and 7.2.6.2. The system must pressurize the sprinkler pipe within 30 minutes, 7.2.6.2.2.
53. ____ |_____| ____ Preaction and deluge systems operate upon activation of the detection system.
54. ____ |_____| ____ Riser room is heated, 7.2.5.
55. ____ |_____| ____ Air pressure is set according to the manufacturer's instructions or at least 20 PSI above the trip pressure, 16.2.2.

56. ____|____ | ____ Dry and preaction systems are supervised and water reaches furthest point within the time period provided on the plans or water delivery calculations in accordance with Table 7.2.3.6.1.
57. ____|____ | ____ Preaction systems exceeding 20 sprinklers automatically supervise (constant monitoring) pipe pressure (maintain at least 7 PSI) and detection devices, 7.3.2.4.

Additional Comments:

Inspection Date: _____ Approved or Disapproved FD Inspector: _____
Inspection Date: _____ Approved or Disapproved FD Inspector: _____
Inspection Date: _____ Approved or Disapproved FD Inspector: _____

NFPA 13 Sprinkler Installation Certification

Permit #: _____ Date: _____

	Property Protected	System Installer	System Supplier
Business Name:			
Address:			
Representative:			
Telephone:			

Location of Plans: _____

Location of Owner's Manual: _____

1. Certification of System Installation: Complete this section after system is installed, but prior to conducting operational acceptance tests.

This system installation was inspected and found to comply with the installation requirements of:

_____ NFPA 13
_____ IFC and IBC
_____ Manufacturer's Instructions
_____ Other (specify: FM, UL, etc.) _____

Print Name: _____

Signed: _____ Date: _____

Organization: _____

2. Certification of System Operation: All operational features and functions of this system were tested and found to be operating properly in accordance with the requirements of:

_____ NFPA 13
_____ IFC and IBC
_____ Manufacturer's Instructions
_____ Other (specify) _____

Print Name: _____

Signed: _____ Date: _____

Organization: _____

RSN: *1166825*
Permit #: *2016-1212653-LT*

Western States Fire Protection Co.

Protecting Lives and Property

Fire Sprinkler Systems
Material Data
For
The Medical Center of Aurora
Pediatrics
3rd 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 21, 2016

RSN: 1166825
Permit #: 2016-1212653-LT

Bulletin 034 Rev. C

Reliable®

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.

RSN: *1166825*
Permit #: *2016-1212653-LT*

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

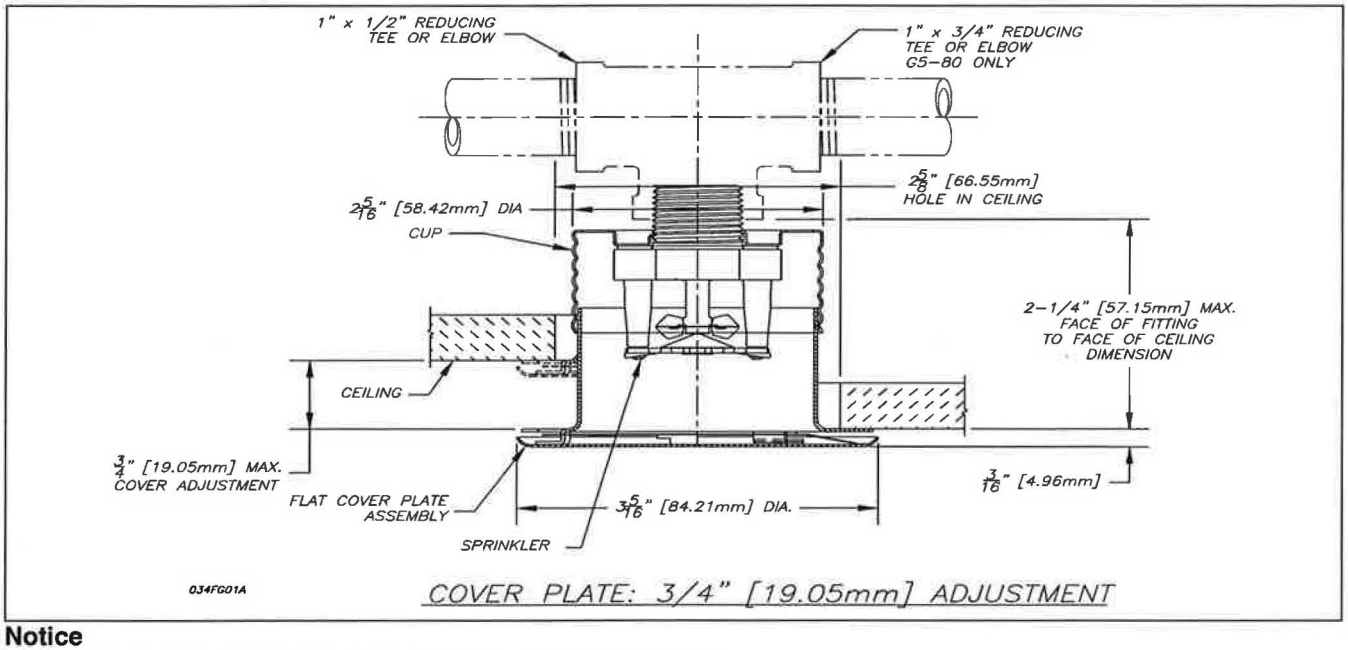
Classification	Sprinkler	Cover Plate	Max. Ambient Temp.
Ordinary	165°F/74°C	135°F/57°C	100°F/38°C
Intermediate	212°F/100°C	165°F/74°C	150°F/66°C

RSN: ***1166825***
Permit #: ***2016-1212653-LT***

Technical Data

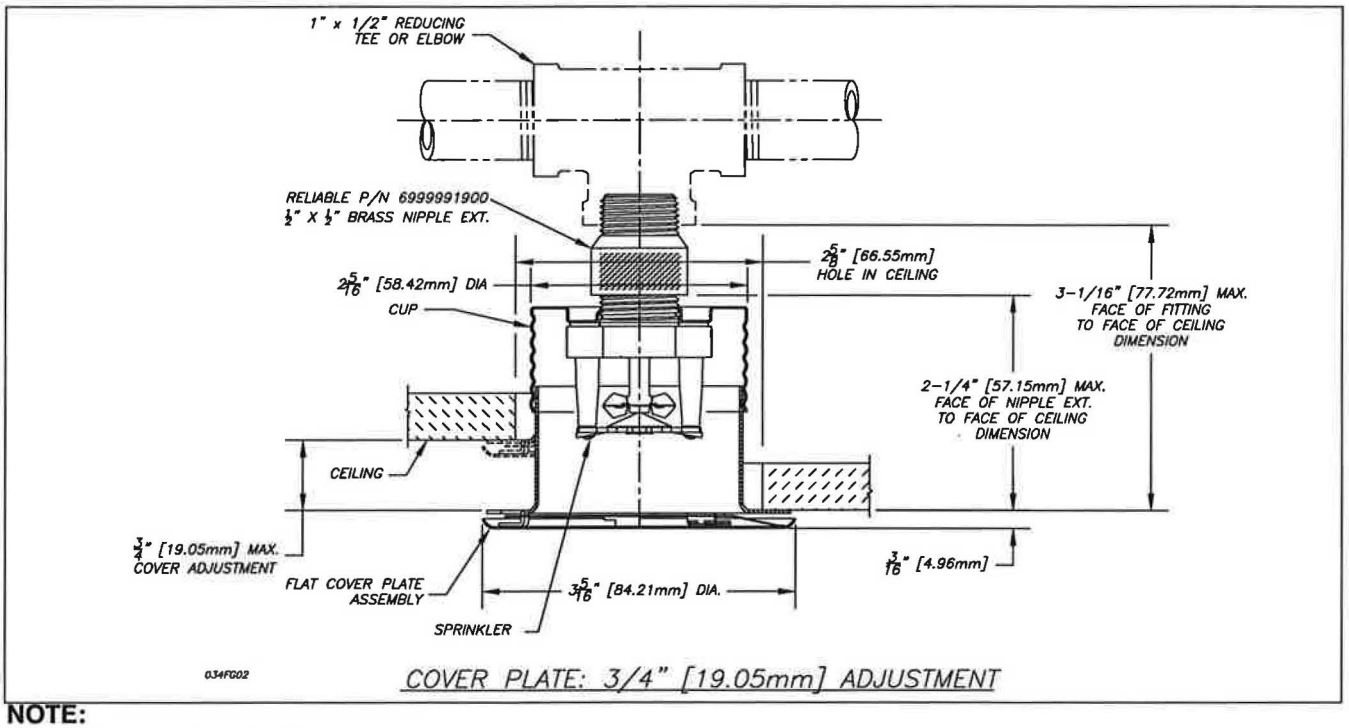
Sprinkler Model	Sprinkler Inlet	Total Adjustment	Nominal Orifice	Nominal K Factor		Thread	Approvals	Sprinkler Identification (SIN)
				US	Metric			
G5-80	Non Adjustable	¾" (19mm)	17/32" (15mm)	8.0	115	¾" NPT (R¾)	1	RA3412
G5-56	Non Adjustable	¾" (19mm)	½" (15mm)	5.6	80	½" NPT (R½)	1,2,3,4,5	RA3415
G5-42	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: *1166825*
Permit #: *2016-1212653-LT*

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.

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RSN: *1166825*
Permit #: *2016-1212653-LT*

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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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.

Pipe Fittings & Steel Nipples

www.anvilintl.com

RSN: *1166825*
Permit #: *2016-1212653-LT*



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Permit #: 2016-1212653-LT

Cast Iron Threaded Fittings

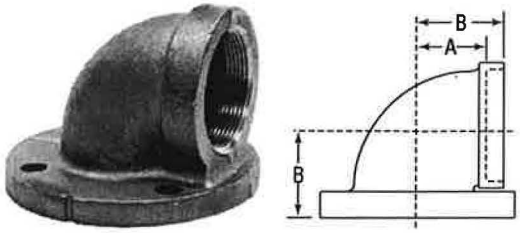
Class 125 (Standard)

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.

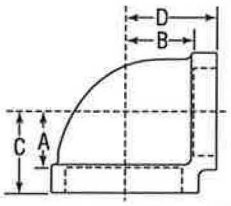
RSN: 1166825
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Cast Iron Threaded Fittings

Class 125 (Standard)

FIGURE 352
90° Elbow, Reducing





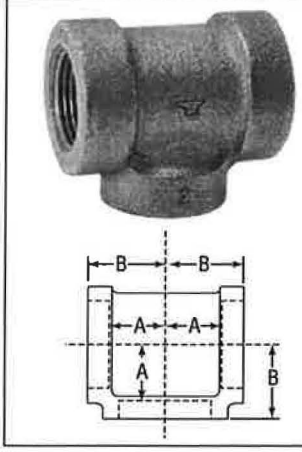
Size				A		B		C		D		Unit Weight Black	
NPS	DN	NPS	DN	in	mm	in	mm	in	mm	in	mm	lbs	kg
1/2	15	1/4	8	5/8	16	3/4	19	1 1/16	27	1 1/16	27	0.40	0.18
		3/8	10	5/8	16	11/16	17	1 1/16	27	1 1/16	27	0.34	0.15
3/4	20	1/2	15	11/16	17	13/16	22	1 1/4	32	1 1/4	32	0.51	0.23
1	25	1/2	15	11/16	17	15/16	24	1 3/8	35	1 3/8	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)

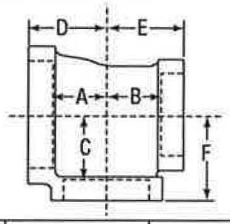
FIGURE 358
Tee



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.

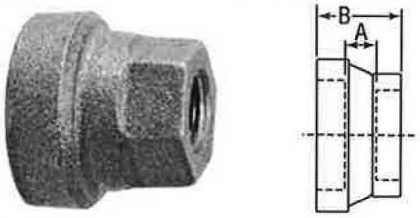
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RSN: 1166825
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Cast Iron Threaded Fittings

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.

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Permit #: *2016-1212653-LT*

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.



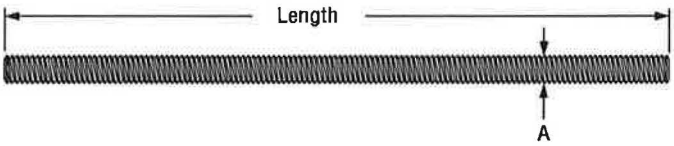


FIG. 146:
LOADS (LBS) • WEIGHTS (LBS) • DIMENSIONS (IN)

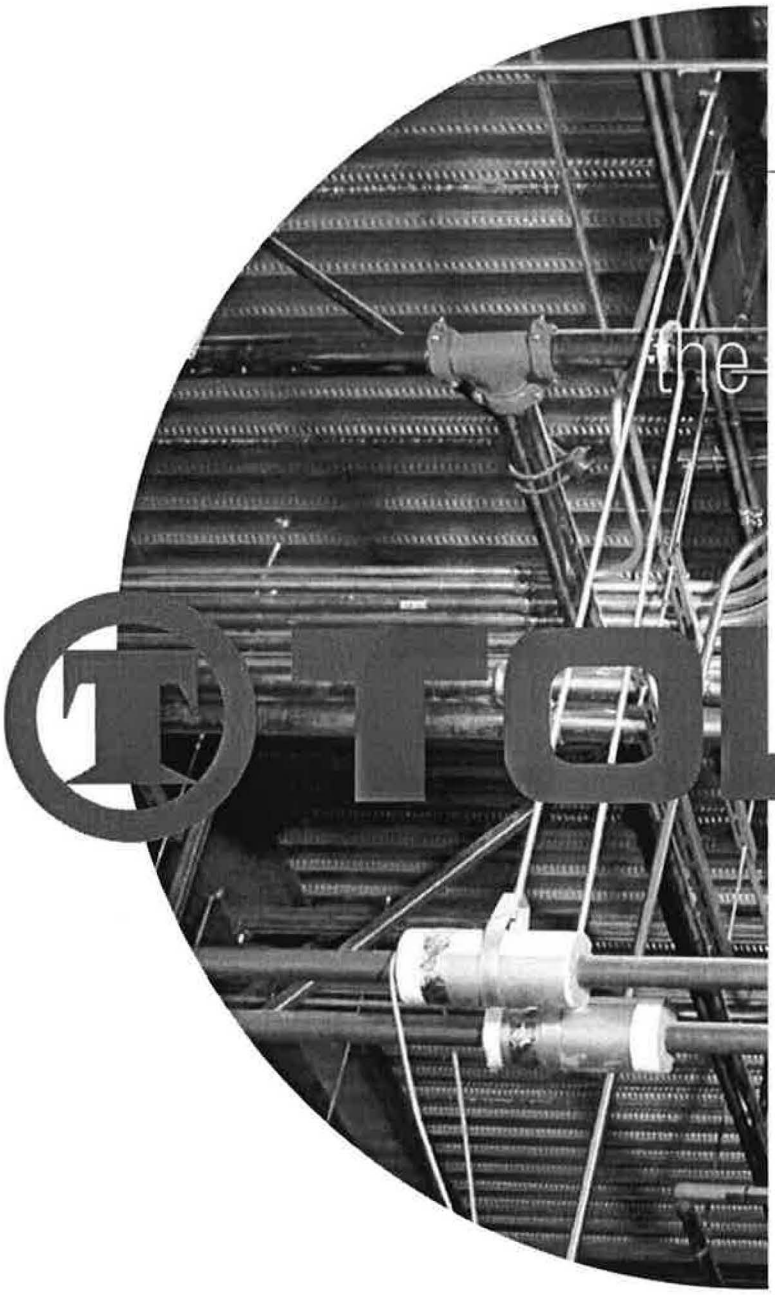
Rod Size A	Threads per Inch	Max Load 650° F	Weight per Ft.
1/4	20	240	0.12
3/8	16	730	0.30
1/2	13	1,350	0.53
5/8	11	2,160	0.84
3/4	10	3,230	1.20
7/8	9	4,480	1.70
1	8	5,900	2.30
1 1/4	7	9,500	3.60
1 1/2	6	13,800	5.10

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: ***1166825***
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TOLCO™ Fire Protection Support Systems



Supporting the Flow.™

TOLCO™

Pipe Hangers
Supports
Seismic Bracing

UL Listed
for Fire Sprinkler
Installations

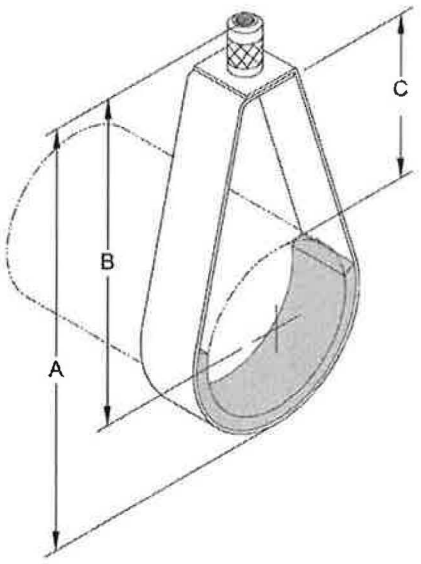
TOLCO™ is a brand of NIBCO

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Permit #: *2016-1212653-LT*

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.

RSN: *1166825*
Permit #: *2016-1212653-LT*

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

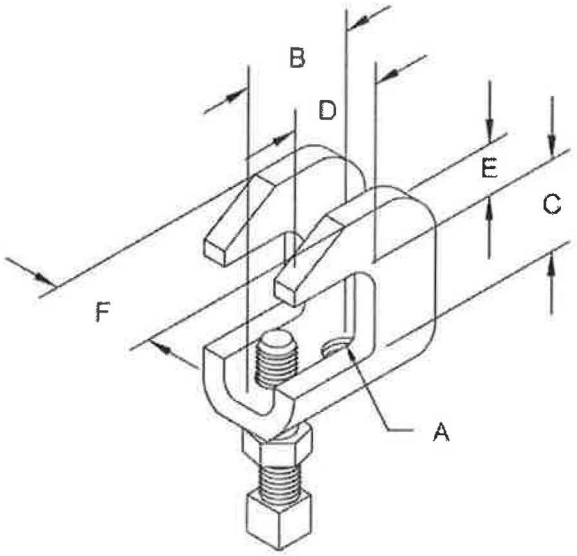


Fig. 65

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.

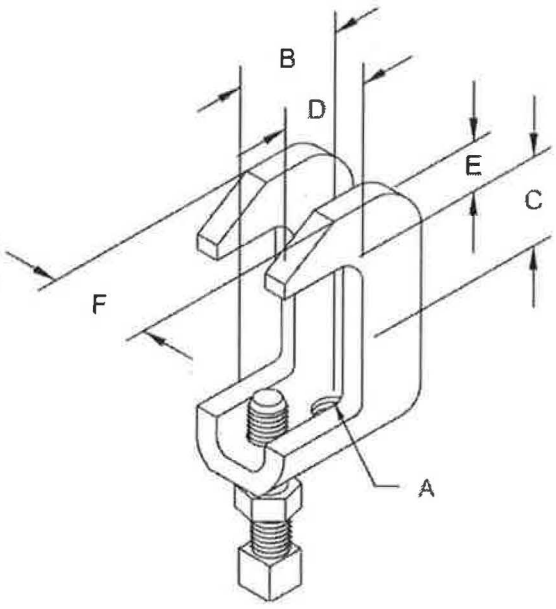


Fig. 66

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
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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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RSN: 1166825
Permit #: 2016-1212653-LT

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.

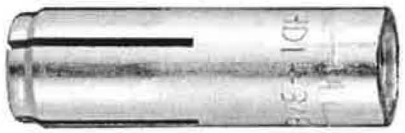
Product features

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

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

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