Design, Installation, Oper
and Maintenance Man

Reviewed for Code Compliance
Inspections Division
Approved with Conditions
Date: 01/04/14

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ULC EX15315/CEX887

P/N 60-9127100-000
April 2009

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Foreword

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Note: This Manual, P/N 60-9127100-000, is to be used by qualified and fa knowledgeable of NFPA standards, and any other applicable standards in effect

This manual is intended to describe the design, installation, operation and maintena Suppression Systems.

Badger Fire Protection assumes no responsibility for the application of any systems ot in this manual. The technical data contained herein is limited strictly for informational purposes only. Badger Fire Protection believes this data to be accurate, but it is published and presented without any guarantee or warranty whatsoever. Badger Fire Protection disclaims any liability for any use that may be made of the data and information contained herein by any and all other parties.

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Terms and Abbreviations

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°C:	°Centigrade
°F:	°Farenheit
AC:	Alternating Current
ADA:	Americans with Disabilities Act
ADP:	Appliance-Duct-Plenum
AHJ:	Authority Having Jurisdiction
AMP:	Ampere
AWG:	American Wire Gauge
AC:	Alternating Current
C:	Common
CGA:	Compressed Gas Association
CSA:	Canadian Standards Association
DC:	Direct Current
DIOM:	Design, Installation, Operation, and Maintenance Manual
DM:	Mesquite
DOT:	Department of Transportation
EMT:	Electrical Metallic Tubing
F:	Fryer
ft.:	Feet
GRW:	Gas Radiant/Wok
HMIS:	Hazardous Materials Information System
HP:	Horse Power
HZ:	Hertz (Frequency)
in.:	Inch
lb.:	Pound
LPF:	Low Proximity Fryer
LPR:	Low Proximity Range
m:	Meter
MAX.:	Maximum
MEA:	Materials and Equipment Acceptance
MIN.:	Minimum
mm:	Millimeter
NC:	Normally Closed
NEC:	National Electrical Code
NFPA:	National Fire Protection Association
NO:	Normally Open
NPT:	National Pipe Thread
P/N:	Part Number
PSI:	Pounds per Square Inch
PTFE:	Polytetrafluoroethylene (Teflon)
R:	Range
QTY:	Quantity
SVA:	System Valve Actuator
TC:	Transport Canada
UL/ULI:	Underwriters Laboratories, Inc.
ULC:	Underwriters Laboratories of Canada
Vac:	Volts AC
Vdc:	Volts DC
WHMIS:	Workplace Hazardous Materials Information System

Listings and Approvals

UL: Underwriters' Laboratories Listing File Number - UL EX2458
MEA: New York City Department of Buildings Materials & Equipment Acceptance Division - 94-95-E

RESURGAM CITY OF PORTLAND, MAINE
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Safety Summary

Definitions

- **Note:** Notes are used to call out information that requires extra attention.
- **Caution:** Cautions are placed throughout the manual in areas where the possibility [illegible] damage. The general cautions in the Safety Summary should be adhered to at all ti[illegible] BadgerRange Guard Wet Chemical System.
- **Warning:** Warnings are placed throughout the manual in areas where the possibility of severe property/equipment damage, system failure, personal injury, and in some cases, death could occur. The general warnings in the Safety Summary should be adhered to at all times when working with a Range Guard Fire Systems Wet Chemical System.

General Warnings

WARNING

- Protective eye wear must always be worn when working with pressurized cylinders. Never service the Cylinder and Valve Assembly unless the Anti-Recoil Plate (P/N 255681) and Shipping Inspection Plate (P/N 255096) are installed. Death, serious injury or property damage could occur.
- Under no circumstances while performing cylinder recharge should a charged cylinder be allowed to “free stand” without either the charging apparatus attached or the anti-recoil plate installed. Whenever these devices are not installed, a charged cylinder must be securely clamped to a rigid structure capable of withstanding the full thrust that would result should the valve inadvertently open.
- It is possible that applications involving flammable or combustible liquids and greases could be enclosed within or surrounded by areas that are classified as Class-I or Class-II, Division-1 or Division-2 locations (Zone 1 or Zone 2). Wet chemical system electrical components, such as heat detectors, located within these areas shall be rated for use in classified areas as required, and all wiring to these components shall conform to the provisions of NFPA 70, National Electric Code, for Class-I or Class-II, Division-1 or Division-2 locations (Zone 1 or Zone 2), as required.

  Consult NFPA Standard 70 and NFPA Standard 96 for proper installation of electrical components within and adjacent to grease extraction exhaust systems and grease vapor producing appliances
- Do not use oxygen to blow out piping. The use of oxygen is very dangerous as the possible presence of even a minute quantity of oil may cause an explosion, thereby causing death, serious injury and/or property damage.
- The system uses high pressure. Safety goggles or glasses must be worn. Loosen the fitting slowly and carefully. Bleed all pressure out gradually. Failure to observe these cautions could result in bodily injury.
- The braided High-Pressure Nitrogen Tubing, is required on all installations in which the UCH Control System is connected to a System Valve Actuator (SVA). Use of a different type of connection in such an installation could result in serious personal injury and/or malfunction of the system.
- Never dispose of a pressurized cartridge. Cartridges must be discharged before discarding. Filled gas cartridges may be dangerous if not handled properly. Do not heat cartridges above 120°F (49°C). Death, serious injury and/or property damage could occur. Pressurized cartridges that become overheated can explode, and thereby cause property damage, severe personal injury, and possibly death.

General Cautions

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CAUTION

- Where electric detection and/or actuation is provided, supervision shall be provided in accordance with NFPA 17A. Alarms and indicators, along with a supervisory power source, shall be provided in accordance with NFPA 72, National Fire Alarm Code. Electrical wiring and equipment shall be provided in accordance with NFPA 70, National Electric Code. All installations are subject to the approval of the Authority Having Jurisdiction (AHJ).
- When using the UCH Control System, a System Nitrogen Cartridge, P/N 87-120043-001, is required for final system set up. When using the A+ Control Box, a CO_2 Cartridge, P/N 06-235557-001, is required for final system setup. Using any other cartridge could cause malfunction or non-function of the system.
- No action shall be taken by the system owner other than visual. If further maintenance is determined necessary as a result of owner inspection, contact an authorized Badger Distributor.
- Do not attempt to recharge any cylinder with out first checking for last hydrostatic test date. The U.S. Department of Transportation (DOT) and Transport Canada (TC) has ruled that any pressurized container of the type used in wet chemical systems shall not be recharged or transported with out first being inspected internally and externally and hydrostatically tested if more than five (5) years have elapsed since the date of the last hydrostatic test. Regardless of previous inspection dates, it is illegal to refill any pressurized container that leaks, which bulges, has defective safety devices, bears evidence of physical abuse, fire or heat damage, or detrimental rusting or corrosion, until it is properly repaired and requalified as specified in DOT and TC regulations. For more information, refer to Compressed Gas Association (CGA) Pamphlet C-6.

GENERAL PRECAUTIONS

The following general safety precautions are to be observed at all times:

1. All electrical components associated with equipment shall be installed and grounded in accordance with NEC and local regulatory requirements.
2. Special precautionary measures are essential to prevent applying power to equipment at any time maintenance work is in progress.
3. Before working on electrical equipment, use a voltmeter to ensure that system is not energized.
4. When working near electricity, do not use metal rulers, flashlights, metallic pencils, or any other objects having exposed conductive material.
5. When connecting a meter to terminals for measurement, use a voltage range higher than expected voltage to be measured.

Pressurized Cylinders

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The Range Guard fire suppression systems use pressurized equipment; therefore, pers
suppression systems must be aware of the dangers associated with the improper handl
tenance of this equipment.

Fire suppression system service personnel must be thoroughly trained in the proper ha
service of Range Guard equipment and follow the instructions used in this manual and

Badger has provided warnings and cautions at appropriate locations throughout the text of this manual. These warnings and cautions are to be adhered to at all times. Failure to do so may result in property/equipment damage, serious personal injury, and even death.

SAFETY BULLETIN 1, MARCH 2, 1987

SUBJECT: SAFE CYLINDER HANDLING PROCEDURES

WARNING

Pressurized (charged) cylinders are extremely hazardous and if not handled properly are capable of violent discharge. This may result in death, serious personal injury, and/or property damage.

Before handling Badger system products, all personnel must be thoroughly trained in the safe handling of the cylinders as well as in the proper procedures for installation, removal, filling, and connection of other critical devices, such as System Valve Actuators (SVAs).

READ, UNDERSTAND and ALWAYS FOLLOW the operation and maintenance manuals, owners manuals, service manuals, etc., that are provided with the individual systems.

The following safety procedures must be observed at all times:

Moving Cylinders: Cylinders must be shipped compactly in the upright position, and properly secured in place. Containers must not be rolled, dragged or slid, nor allowed to be slid from tailgates of vehicles. A suitable hand truck, fork truck, roll platform or similar device must be used.

Rough Handling: Cylinders must not be dropped or permitted to strike violently against each other or other surfaces.

Storage: Cylinders must be stored standing upright where they are not likely to be knocked over, or the cylinders must be secured.

For additional information on safe handling of compressed gas cylinders, see CGA Pamphlet PI titled “Safe Handling of Compressed Gases in Containers”. CGA pamphlets may be purchased from The Compressed Gas Association, Crystal Square Two, 1725 Jefferson Davis Highway, Arlington, VA 22202.

SAFETY BULLETIN, May 1, 1993

SUBJECT: SAFE CYLINDER HANDLING PROCEDURES

SUBJECT: SAFE CYLINDER HANDLING PROCEDURES FOR 175 PSI BADGER WE CYLINDERS

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Date: 01/04/14

WARNING

Pressurized (charged) cylinders are extremely hazardous and if not handled properly are capable of violent discharge. This will result in serious bodily injury, death and property damage.

BEFORE handling Badger system products, all personnel must be thoroughly trained in the safe handling of the containers as well as in the proper procedures for installation, removal, filling, and connection of other critical devices, such as System Valve Actuators (SVAs).

READ, UNDERSTAND and ALWAYS FOLLOW the operation and maintenance manuals, owners manuals, service manuals and other information that is provided with the individual systems.

THESE INSTRUCTIONS MUST BE FOLLOWED IN THE EXACT SEQUENCE AS WRITTEN TO PREVENT SERIOUS INJURY, DEATH OR PROPERTY DAMAGE.

Anti-Recoil Plate

a. Each Badger Range Guard cylinder is factory equipped with a Anti-Recoil Plate installed on the valve outlet to prevent loss. This device is a safety feature, and will provide controlled safe discharge when installed if the cylinder is actuated accidentally.
b. The valve diffuser plate must be installed in the valve outlet AT ALL TIMES except when the cylinders are connected into the system piping or being filled, at which time the cylinders shall be securely attached to bracket mounts.

Valve Protection Plate/Shipping Cap

A Valve Protection Plate/Shipping Cap is factory installed on the actuation port to prevent loss. The Valve Protection Plate/Shipping Cap is attached to the actuation port to prevent tampering or depression of the actuating pin. No attachments (e.g., System Valve Actuators) are to be connected to the actuation port during shipment, storage or handling.

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CHAPTER 1
GENERAL INFORMATION

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1-1 INTRODUCTION

The Range Guard Wet Chemical System provides fire protection for commercial kitchen applications such as appliances and ventilation.

The Wet Chemical system holds UL and ULC listings as a pre-engineered system.

Systems shall be designed and implemented according to the following:

- NFPA Standard 17A, “Standard for Wet Chemical Systems”
- NFPA Standard 96, "Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations"
- Other applicable NFPA standards as required for a particular application and design, including, but not limited to, NFPA 70 (NEC), and NFPA 72, Fire Alarm Standard and CSA
- This Design, Installation, Operation, and Maintenance Manual (DIOM)
- Any other standards enforced by a local Authority Having Jurisdiction (AHJ)

Configurations in Chapter 3, System Design, are tested and listed to Underwriters Laboratories (UL) Standard 300, 1994 Edition, unless otherwise noted, and Underwriters Laboratories of Canada ORD 1254.6.

1-2 CLASSIFICATION OF FIRE

The classification of fire is defined in NFPA 1, Section 3.3.102 as the following:

- Class A: Surface Type Fires; wood or other cellulose-type material (ordinary combustibles)
- Class B: Flammable liquids
- Class C: Energized electrical equipment
- Class D: Combustible metals (such as magnesium, sodium, zirconium, potassium, and titanium)
- Class K: Combustible cooking media (vegetable or animal oils and fats)

Note: Range Guard Wet Chemical system is suited for Class K type of fire. (This system does not supersede the requirements for portable fire extinguishers as defined in NFPA 10.)

1-3 GENERAL CHARACTERISTICS OF THE BADGER SYSTEM

The Range Guard System is a wet chemical fire suppression system with one type of agent. The system is capable of encompassing a wide variety of application requirements.

The system utilizes stored pressure agent cylinders. Stored pressure cylinders:

- Remain free of contamination
- Provide a smooth flow throughout the discharge

The cylinders are powder-coated, welded mild-steel shell conforming to DOT/TC specification 4BW/4BA construction and NFPA standards. The valve is forged brass with nickel plating. The plating and cylinder coating makes it corrosion resistant.

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The system can be activated mechanically from manual release, thermo-bulb link

The system can be activated electrically with a 24 Vdc compatible alarm control and listed with the Range Guard system. Both automatic detection and manual used on control panels. Refer to Paragraph 2-2.1.5 for power requirements.

Cylinders are activated from stored high-pressure gas. Automatic and manual act for the Range Guard System.

Other actuations are available, such as:

- Mechanical gas valve closure
- Dry contacts for annunciation and electrical shutdowns

1-4 SYSTEM DESCRIPTION

The Range Guard Wet Chemical System consists of a supply of wet chemical stored in one or more Cylinder and Valve Assemblies. Each cylinder is pressure activated by a System Valve Actuator.

The system can be actuated either automatically and/or manually, using mechanical, electrical, or pressure actuation devices. Upon actuation, the wet chemical is discharged through agent distribution piping and specially designed nozzles positioned throughout the protected area.

Figure 1-1. Typical Range Guard Wet Chemical System

1-5 OPERATIONAL SEQUENCE

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Figure 1-2. Operational Sequence Flow Chart

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1-6 APPLICATIONS AND LIMITATIONS OF WET CHEMICALS

The Range Guard system uses a liquid chemical called Karbaloy® as its agent. I
of potassium carbonate in water, suppresses fires through a process involving th

- Saponification of surface grease (turning it into combustion-resistant soap),
- Cooling effects of water vaporization,
- Inerting effects of resultant steam formation, and
- Interruption of the chemical chain reaction of combustion.

Hazards and equipment that can be protected using wet chemical extinguishing systems include the following:

- Restaurant, commercial, and institutional hoods
- Plenums, ducts, and filters with their associated cooking appliances
- Special grease removal devices

The wet chemicals used in the Range Guard Wet Chemical System are stable at both low and high temperatures. The upper storage temperature limit for the system is 120°F (49°C). The lower temperature limit is 0°F (-18°C).

WARNING

Upon system alarm notification, all personnel must evacuate the protected space. Failure to do so may result in temporary respiratory difficulties, disorientation, or personal injury.

1-6.1 Extinguishing Properties

When Karbaloy wet chemical agent is applied in a concentrated liquid spray to a burning surface, it reacts quickly with the hot grease or oil to produce a foam blanketing the surface. This reaction, combined with the cooling effect of the Karbaloy wet chemical agent, also reduces the possibility of fire reflash.

1-7 HAZARDOUS MATERIALS INFORMATION SYSTEM (HMIS^{SM})

The HMIS rating for Karbaloy wet chemical is as follows:

- Health (H) = 2
- Flammability (F) = 0
- Reactivity (R) = 0

CAUTION

Wet chemical fire extinguishing agent is considered nontoxic, but is classified as a skin/eye irritant, and may cause temporary irritation to the eyes, skin, or respiratory system. Avoid unnecessary exposure.

Refer to http://www.badgerfire.com web site for latest MSDS information.

1-8 WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WI

The WHMIS rating for Karbaloy wet chemical is — D2B - Skin/Eye Irritatic

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Figure 1-3. WHMIS Class B — Division 2 (D2B) Symbol

1-9 CLEAN-UP

No unusual cleanup procedure is required. After the appliances have completely cooled, the residue from the discharge may be cleaned up with a wet cloth or sponge. Wear rubber gloves while cleaning. If skin or eyes come in contact with the agent, flush thoroughly with water.

WARNING

Do not disturb the foam until the cooking appliances, plenum, and duct have cooled sufficiently. Do not put water on hot grease as this will cause violent steaming and spattering.

WARNING

Karbaloy wet agent is electrically conductive. To avoid electric shock, de-energize all electric circuits to appliances, outlets, and wiring by disconnecting or turning off the electric power at the main fuse or circuit breaker box. Do not clean up Karbaloy wet agent or touch electric appliances, outlets, power cords, or other wiring with electric power on.

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CHAPTER 2
COMPONENT DESCRIPTION

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The Range Guard Wet Chemical Fire Suppression System consists components:

- Suppression — Agent storage cylinders distribution piping, nozzles, and detection devices (mechanical and electrical)
- Controls
- Auxiliary Components

Cylinder and Valve Assembly

The Wet Chemical Fire Suppression System utilizes five sizes of cylinders. The cylinders consist of a factory-filled wet chemical agent and valve assembly. The cylinders conform to DOT/TC specification 4BW/4BA and NFPA standards.

Distribution Piping

The distribution piping (not supplied by Badger Fire Protection) is designed to distribute the wet chemical agent to the hazard areas. In the Range Guard pre-engineered system, pipe sizes, minimum and maximum pipe lengths and number of pipe fittings are predetermined. See Chapter 3 for more details.

Nozzles

There are seven types of nozzles for the Wet Chemical Fire Suppression System. Each type of nozzle has been designed and tested for specific applications and areas of coverage. The nozzles are:

- ADP
- R
- LPF
- LPR
- GRW
- F
- DM

Detection Devices

There are two methods of detection that can be employed in the system: mechanical or electrical.

Mechanical detection uses fusible-link or thermo-bulb link detectors to provide reliable performance. The detectors are designed to separate at a specific temperature and release tension on the detection cable which causes the release mechanism to activate. Fusible-link detectors are available in four temperature ratings, and the thermo-bulb detectors are available in six temperature ratings.

Electrical detection uses heat detectors that are equipped with self-restoring, normally-open contacts which close when a predetermined temperature is reached. Heat detectors are available in six set points.

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UCH Control System

The UCH Control System is used for actuating the Range Guard Cylinder a
The UCH Control System can be mounted directly on the cylinder or to a wa
System can be operated with:

- Automatic mechanical detection (fusible-links and thermo-bulb links)
- Remote and local manual operation
- Automatic electrical activation

A+ Control Box

The A+ Control Box is used for actuating the Range Guard Cylinder and Valve Assembly and mounted directly to a wall. The A+ can be operated with:

- Automatic mechanical detection (fusible-links and thermo-bulb links),
- Remote manual operation.

2-1 SUPPRESSION COMPONENTS

2-1.1 Cylinder and Valve Assembly, P/N B12000X

Table 2-1 outlines the dimensions for each Cylinder and Valve Assembly model.

The DOT Cylinder and Valve Assembly:

- Conforms to DOT/TC Specification 4BW/4BA
- Cylinder and Valve Assembly is pressurized with nitrogen to 175 PSIG (12.1 bar) at 70°F (21°C)

WARNING

Protective eye wear must always be worn when working with pressurized cylinders. Never service the Cylinder and Valve Assembly unless the Anti-Recoil Plate (P/N 255681) and Valve Protection Plate (P/N 255096) are installed. Death or serious injury and/or property damage could occur as the cylinder may be violently propelled. Refer to the Safety Summary for more information regarding pressurized cylinders.

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Figure 2-1. Dimensions of Cylinder and Valve Assembly, P/N B-12XXXX

Refer to Figure 5-26 for Cylinder Valve details.

Table 2-1. Cylinder and Valve Assembly Specifications

Cylinder and Valve Assembly Part Number (Old P/N)	Model	Maximum Flow Number	Dimensions		
			A	B	C
60-120001-001 (B120001)	RG-1.25G	4	15-1/4 in. (387 mm)	13-3/4 in. (349 mm)	8 in. (203 mm)
60-120002-001 (B120002)	RG-2.5G	8	21 in. (534 mm)	19-5/8 in. (498 mm)	9 in. (230 mm)
60-120003-001 (B120003)	RG-4GS	12	19 in. (483 mm)	17-1/2 in. (444 mm)	12-1/4 in. (311 mm)
60-120006-001 (B120006)	RG-4GM	12	24-3/8 in. (619 mm)	23 in. (584 mm)	10 in. (254 mm)
60-120005-001 (B120005)	RG-6G	18	35-1/8 in. (892 mm)	33-3/4 in. (857 mm)	10 in. (254 mm)

Note: It is permisible to use old and/or new cylinders included in this manual on a Range Guard system.

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2-1.1.1 CYLINDER BRACKETS

Figure 2-2. Mounting Brackets

Table 2-2. Mounting Bracket Dimensions

Part No.	Model	Dimensions		
		A	B	C
9197430	RG-1.25G	3 in. (76 mm)	9-3/8 in. (238 mm)	1-3/8 in. (35 mm)
9197263	RG-2.5G	4-1/2 in. (114 mm)	12 in. (305 mm)	2-1/2 in. (64 mm)
9197414	RG-4GM	4-1/2 in. (114 mm)	20-1/2 in. (521 mm)	2-1/2 in. (64 mm)
9197415	RG-4GS	4-1/2 in. (114 mm)	11-1/2 in. (290 mm)	2 in. (51 mm)

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Figure 2-3. Shelf Bracket, P/N 100013

Table 2-3. Mounting Bracket Dimensions

Part No.	Model	Dimensions		
		A	B	C
100013	RG-6G RG-4GM	11 in. (279 mm)	10-1/8 in. (258 mm)	21-1/8 in. (537 mm)

2-1.1.1.1 Floor Mount Bracket Kit, P/N 100010

A Floor Mount Bracket Kit is used for mounting the RG-6G/RG-4M cylinder to the floor. The Floor Mount Bracket Kit requires Wall Mounting Bracket P/N 100013.

Figure 2-4. Floor Mount Bracket Kit, P/N 100010

Table 2-4. Floor Mounting Kit Specifications

Dimension A	Dimension B	Dimension C
3 in. (76 mm)	9-5/8 in. (245 mm)	6-9/16 in. (168 mm)

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2-1.1.2 DISCHARGE ADAPTER KIT, P/N 83-844908-000

The Discharge Adapter provides a means to connect agent distribution pipe to a Chemical Cylinder and Valve Assemblies.

The Discharge Adapter Kit consists of a 3/4-inch NPT external thread and 1/2 thread adapter and a steel flange plate (Figure 2-5).

Note: The nuts and bolts used to secure the Anti-Recoil Plate to the discharge valve should be retained and used for mounting the Discharge Adapter to the valve outlet.

The Discharge Adapter can also be used as a recharge adapter to pressurize the cylinder with nitrogen after filling with wet chemical.

Note: This part must be ordered separately. It is not included with the Cylinder and Valve Assembly.

Figure 2-5. Discharge Adapter Kit, P/N 83-844908-000

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2-1.1.3 DISCHARGE NOZZLES

There are essentially seven types of nozzles in the Range Guard wet chemi

- ADP
- F
- DM
- R
- GRW
- LPF
- LPR

Each nozzle has:

- Stainless steel internal strainer and nickel-chrome plated brass body
- Special foil seal over the discharge orifice to prevent grease from depositing in the orifice and plugging the nozzle
- Grooved rings on the body define the nozzle type (Refer to Table 2-5)
- Body is stamped with nozzle type and Kidde/RG as shown in Figure 2-6.

Figure 2-6. Example of Nozzle Stamped with Nozzle Type and Kidde/RG

Note: Refer to Table 2-5 for a list of old and new Range Guard nozzle part numbers listed with this system. It is permissible to use older and/or newer nozzles included in Table 2-5 in the same Range Guard system. For example, an old ADP nozzle (P/N B120011) marked "Range Guard" can be used in the same system with new nozzles marked "KIDDE/RG".

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Table 2-5. Range Guard Nozzles

Nozzle Type	Part Number (Old Part Number)	Flow Number	Grooves	
ADP Nozzle	87-120011-001 (B120011)	1	1	
F Nozzle	87-120012-001 (B120012)	2	2	
GRW Nozzle	87-120013-001 (B120013)	1	3	
R Nozzle	87-120014-001 (B120014)	1	4	
DM Nozzle	87-120015-001 (B120015)	3	0	
LPF Nozzle	87-120022-001 (B120022)	2	1 & 4	
LPR Nozzle	87-120024-001 (B120024)	1	Disc & Core	

Note: It is permissible to use old and/or new nozzles included in this manual in a Range Guard system.

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2-1.1.3.1 ADP Nozzle, P/N 87-120011-001

ADP nozzles are used for the following hazards:

- Ducts
- Plenums
- Flat cooking surfaces (griddle)
- Split Vat Deep Fat Fryers (low proximity)
- Upright Broilers (Salamander)
- Closed-top Chain Broilers
- Open-top Chain Broilers
- Natural/Mesquite Charcoal Charbroiler
- Krispy Kreme Model 270 d/h Donut Fryer

Figure 2-7. ADP Nozzle, P/N 87-120011-001

2-1.1.3.2 F Nozzle, P/N 87-120012-001

F nozzles are used for the following hazards:

- Fryers
- Tilt Skillets/Braising Pans
- Pumice Rock (Lava, Ceramic)
- Charbroilers

Figure 2-8. F Nozzle, P/N 87-120012-001

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2-1.1.3.3 GRW Nozzle, P/N 87-120013-001

GRW nozzles are used for the following hazards:

- Woks
- Electric Charbroiler (Open Grid)
- Radiant Charbroiler

Figure 2-9. GRW Nozzle, P/N 87-120013-001

2-1.1.3.4 R Nozzle, P/N 87-120014-001

R nozzles are used for the following hazard:

- Ranges

Figure 2-10. R Nozzle, P/N 87-120014-001

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2-1.1.3.5 DM Nozzle, P/N 87-120015-001

DM nozzles are used for the following hazards:

- Mesquite Charbroiler (Chips, Wood, Logs)

Figure 2-11. DM Nozzle, P/N 87-120015-001

2-1.1.3.6 LPF Nozzle, P/N 87-120022-001

LPF nozzles are used for the following hazard:

- Fryers

Figure 2-12. LPF Nozzle, P/N 87-120022-001

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2-1.1.3.7 LPR Nozzle, P/N 87-120024-001

LPR nozzles are used for the following hazard:

- Ranges

Figure 2-13. LPR Nozzle, P/N 87-120024-001

2-1.1.3.8 Swivel Adapter, P/N 87-120021-001

The swivel adapter may be used conjunction with any nozzle.

Figure 2-14. Swivel Adapter, P/N 87-120021-001

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2-2 CONTROLS

2-2.1 UNIVERSAL CONTROL HEAD (UCH) Control System, P/N B120099

The UCH Control System, P/N B120099, is used for actuating the Range C
Assembly. The UCH Control System can be attached to the System Valve A
direct cylinder mounting, or to a wall for remote mounting. Knockouts are
either type of mounting. The controller can be operated with:

- Automatic mechanical detection (fusible-links and thermo-bulb links),
- Automatic electrical operation, and
- Remote and local manual operation.

Figure 2-15. UCH Control System, P/N B120099

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2-2.1.1 SYSTEM NITROGEN CARTRIDGE, P/N 87-120043-001 (OLD P/N B120043)

The UCH Control System uses a nitrogen cartridge for actuating the wet chemi charged with dry nitrogen (see Figure 2-16). The cartridge is mounted inside the U to protect it from tampering and provides the date of manufacturing and sp recording the installation date.

Figure 2-16. System Nitrogen Cartridge, P/N 87-120043-001

Note: New system cartridges (P/N 87-120043-001) are marked "P/N 87-120043-001". Old system cartridges (P/N B120043) are not marked with a part number. It is permissible to use old and/or new system cartridges included in this manual in a Range Guard system.

2-2.1.2 TEST CARTRIDGE, P/N 87-120044-001 (OLD P/N B120044)

The Test Cartridge is used for testing of the Badger Wet Chemical System. The cartridge has a red band and is labeled “TEST CARTRIDGE” as shown in Figure 2-17.

Note: The System Nitrogen Cartridge P/N 87-120043-001 is required for actuation and full discharge or "puff" tests.

CAUTION

The Test Cartridge (P/N 87-120044-001) must be removed and the System Nitrogen Cartridge (P/N 87-120043-001) must be installed at the completion of any work done on the system. Failure to do so will result in malfunction of the system.

Figure 2-17. Test Cartridge, P/N 87-120044-001

Note: New test cartridges (P/N 87-120044-001) are marked "P/N 87-120044-001". Old test cartridges (P/N B120044) are not marked with a part number. It is permissible to use old and/or new test cartridges included in this manual in a Range Guard system.

2-2.1.3 SYSTEM VALVE ACTUATOR (SVA), P/N B120042

A System Valve Actuator (SVA) is mounted to every wet chemical cyli
Figure 2-18). The SVA has ports for low profile tubing runs, and is also equi
plunger that locks the piston in the discharged position, ensuring cc
cylinder(s) contents.

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Figure 2-18. System Valve Actuator (SVA), P/N B120042

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2-2.1.4 HIGH-PRESSURE NITROGEN TUBING, P/N B120045

WARNING

The braided High-Pressure Nitrogen Tubing, is required on all installa UCH Control System is mounted to a wet chemical cylinder. Use of an an installation could result in death or serious personal injury and/or system.

The High-Pressure Nitrogen Tubing is used to connect the UCH Control System to the SVA (see Figure 2-19). A 1/8-inch NPT (male) x 3/8-24 JIC Adapter is included with the High Pressure Nitrogen Tubing.

Figure 2-19. External Tubing for UCH Control System, P/N B120045

Table 2-6. External Tubing for UCH Control System

Part Number	Length "A"
B120045-001	7-1/2 in. (191 mm)
B120045-002	24 in. (610 mm)
B120045-003	60 in. (1524 mm)

2-2.1.5 SOLENOID, P/N B100034

Note: Where electric detection and/or actuation is provided, supervis
accordance with NFPA 72. Alarms and indicators, along with a
shall be provided in accordance with NFPA 72, National Fire Alar
and equipment shall be provided in accordance with NFPA 70, N
installations are subject to the approval of the Authority Having Ju

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An optional solenoid can be installed into the UCH Control System, just under the actuation latch. The solenoid operates directly on the actuation latch to activate the system. This installation allows simultaneous usage of mechanical detection lines, or the lines can be locked out. The solenoid includes two mounting bolts, the bracket and a push plate which mounts onto the solenoid body (see Figure 2-20). The solenoid coil is 24 Vdc at 1.5 Amp and at 70°F (21°C).

Note: When actuating the UCH Control System with an optional solenoid, a UL Compatible and Listed fire control panel with a supervised power supply is required. For example: Scorpio.

Figure 2-20. Solenoid, P/N B100034

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2-2.1.6 MICROSWITCH KIT, P/N B120039, B120039-501 (FOR UCH)

The Microswitch Kit is a single pole, double-throw switch (see Figure 2-21 and T
in the kit is the microswitch, pigtail assembly and four mounting screws (two sh

Note: Microswitch Kit P/N B120039-501 includes pigtail assembly with white s

The wire leads are 24-inches (610 mm) in length. Four Microswitch Kits can be r
Control System. There are two mounting locations to accommodate the four M
stacked at each mounting location), with EMT ports for each mounting location. This allows for the use of two electrical junction boxes for separation of signal lines and AC lines.

These are used when it is necessary to open or close electrical circuits. The following are examples, but not limited to:

- Electric appliance shutdown
- Make up air shutdown
- Electric gas valve shutdown
- Shuntbreaker/relay

Note: Not for alarm initiation.

Electrical appliances usually have a higher amp rating than the switches. In this case, such appliances shall not be wired directly to the microswitch. A magnetic contactor or relay must be used.

To wire the microswitch for UCH, refer to Figure 4-30.

Figure 2-21. Microswitch Kit, P/N B120039

Table 2-7. Microswitch Electrical Ratings

125/250 Vac	20.5 Amps
250 Vac	1-1/2 HP
125 Vac	1/2 HP

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2-2.1.7 TERMINAL TYPE MICROSWITCH KIT, P/N B120047 (FOR UCH)

The Microswitch Kit is a single pole, double-throw switch (see Figure 2-22

Note: Use the Terminal Type Microswitch when using the UCH Contr release functions.

Four Microswitch Kits can be mounted in the UCH Control System. There a to accommodate the four Microswitch kits (two stacked at each mounting for each mounting location. This allows for the use of two electrical junction boxes for separation of signal lines and AC lines.

Microswitch to be used for

- Alarm initiation
- Solenoid release

Electrical appliances usually have a higher amp rating than the switches. In this case, such appliances shall not be wired directly to the microswitch. A magnetic contactor or relay must be used.

To wire the microswitch for UCH, refer to Figure 4-35 and Figure 4-36.

Figure 2-22. Terminal Type Microswitch, P/N B120047

Table 2-8. Terminal Type Microswitch Electrical Ratings

250 Vac	15 Amps
250 Vac	1/2 HP
125 Vac	1/2 HP

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2-2.2 A+ Control Box, P/N B120010

The A+ Control Box (shown in Figure 2-23) is comprised of a CO_2 cartridge, spr
a discharge lever which discharges the CO_2 cartridge when:

- a thermo-bulb and/or fusible-link separates in any detector or,
- the Remote Manual Release is operated.

The valve, with the CO_2 cartridge, is connected to a System Valve Actuator r
cylinders by 1/4 in. (6 mm) O.D. copper tubing using compression or flare fittings.

Note: The tubing is standard, commercially available tubing and is not supplied with the system.

Figure 2-23. A+ Control Box, P/N B120010 (Cover Removed)

The A+ Control Box can operate a maximum of five cylinders, regardless of size. A System Valve Actuator (B100042) is required on each system cylinder. One is supplied with the A+ Control Box.

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2-2.2.1 SYSTEM/TEST CO_2 CARTRIDGE, P/N 06-235557-001 (OLD P/N 9197

When the CO_2 cartridge discharges, the CO_2 gas pressurizes the 1/4 in. (System Valve Actuator(s), located on the system Cylinder Valve, and act Figure 2-24).

Figure 2-24. CO_2 Cartridge, P/N 06-235557-001

Note: New CO_2 cartridges (P/N 06-235557-001) are marked "P/N 06-235557-001". Old CO_2 cartridges (P/N 9197203) are not marked with a part number. It is permissible to use old and/or new CO_2 cartridges included in this manual in a Range Guard system.

2-2.2.2 CABLE TENSION BLOCK, P/N 9197220

The Cable Tension Block in Figure 2-25 is used to set and maintain tension on the detector cable within the A+ Control Box.

Figure 2-25. Cable Tension Block, P/N 9197220

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2-2.2.3 SINGLE SPDT MICROSWITCH KIT, P/N 9197227 (FOR A+)

The Single SPDT Microswitch Kit is a single pole, double-throw microswitch (s
Table 2-9). Included in the kit:

- Microswitch
- Pigtail assembly
- Mounting bracket and hardware (screws, lock washers and hex nuts)
- Microswitch mounting hardware (screws, lock washers and hex nuts)

The wire leads are 24-inches (610 mm) in length. One Single SPDT Microswitch Kit can be mounted in the A+ Control Box.

These are used when it is necessary to open or close electrical circuits. The following are examples, but not limited to:

- Electric appliance shutdown
- Make up air shutdown
- Electric gas valve shutdown
- Shuntbreaker/relay

Electrical appliances usually have a higher amp rating than the switches. In this case, such appliances shall not be wired directly to the microswitch. A magnetic contactor or relay must be used.

To wire the microswitch for A+, refer to Figure 4-50.

Figure 2-26. Single SPDT Microswitch Kit, P/N 9197227

Table 2-9. SPDT Microswitch Electrical Ratings

125/250/277 Vac	15 Amps
125/250/277 Vac	1/2 HP
125 Vdc	1/2 Amp
250 Vdc	1/4 Amp
120 Vac “L”	5.0 Amp

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2-2.2.4 DUAL SPDT MICROSWITCH KIT, P/N 9197228 (FOR A+)

The Dual SPDT Microswitch Kit consists of two single pole, double-throw (
Figure 2-27 and Table 2-10). Included in the kit:

- Microswitches (2 - cut lever paddle and bent lever paddle microswitch
- Pigtail assembly
- Mounting bracket and hardware (screws, lock washers and hex nuts)
- Microswitch mounting hardware (screws, lock washers, and hex nuts)

The wire leads are 24-inches (610 mm) in length. One Dual SPDT Microswitch Kit can be mounted in the A+ Control Box.

These are used when it is necessary to open or close electrical circuits. The following are examples, but not limited to:

- Electric appliance shutdown
- Make up air shutdown
- Electric gas valve shutdown
- Shuntbreaker/relay

Electrical appliances usually have a higher amp rating than the switches. In this case, such appliances shall not be wired directly to the microswitch. A magnetic contactor or relay must be used.

To wire the microswitch for A+, refer to Figure 4-50.

Figure 2-27. Dual SPDT Microswitch Kit, P/N 9197228

Table 2-10. Dual SPDT Microswitch Electrical Ratings

125/250/277 Vac	15 Amps
125/250/277 Vac	1/2 HP
125 Vdc	1/2 Amp
250 Vdc	1/4 Amp
120 Vac “L”	5.0 Amp

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2-2.3 Automatic Detectors and Accessories

2-2.3.1 DETECTOR HOUSING KIT, P/N 804548 (UCH ONLY)

The Detector Housing Kit, shown in Figure 2-28, consists of the following:

Table 2-11. Detector Housing Kit, P/N 804548

Item	Quantity
7-9/16 in. (192 mm) Detector Housing	1
1/2-inch EMT Connectors	2
Crimp Sleeves	4
"S" Hook	1

These items are used to attach the detectors to the 1/16-inch cable leading to the UCH Control System. The Detector Housing can be configured as an End-of-Line or In-Line bracket.

Figure 2-28. Example of End-of-line and In-line Detector Housing Kit, P/N 804548

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2-2.3.2 UNIVERSAL-LINK HOUSING KIT, P/N 120064

The Universal-Link Housing Kit, shown in Figure 2-29, consists of the foll

Table 2-12. Universal Link Housing Kit, P/N 120064

Item	Quantity
11-1/2 in. (292 mm) Detector Housing	1
Crimp Sleeves	2
"S" Hooks	2

The items above are used to attach the Fusible-Link or Thermo-Bulb Links to the 1/16-inch cable leading to the UCH Control System or A+ Control Box. The Universal-Link Housing can be configured as an End-of-Line or In-Line bracket.

Figure 2-29. Example of End-of-line and In-line Universal Link Housing Kit, P/N 120064

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2-2.3.3 THERMO-BULB LINKS, P/N 87-12009X-XXX (OLD P/N B12009X-XXX)

Thermo-Bulb Links, shown in Figure 2-30, are used in conjunction with Universa (P/N 60-120064-001) and/or Detector Housing Kits (P/N WK-804548-000). ' together with a liquid-filled glass tube (Thermo-Bulb), which bursts at a predeter: allowing the two halves of the link to separate. The types of Thermo-Bulb links a

- Rapid Response
- Standard Response

These Thermo-Bulb links are available in various temperature ratings with a minimum/maximum load rating of 0 lb./50 lb. (0 kg/23kg) (see Table 2-13).

Figure 2-30. Thermo-Bulb Link, P/N 87-12009X-XXX

Table 2-13. Rapid and Standard Response Thermo-Bulb Link Temperature Ratings

Rapid Response Part Numbers (Old Part Numbers)	Standard Response Part Numbers (Old Part Numbers)	Temperature	Color	Maximum Exposure Temperature
87-120095-165 (B120095-165)	87-120090-165 (B120090-165)	165°F (74°C)	Red	100°F (38°C)
87-120095-212 (B120095-212)	87-120090-212 (B120090-212)	212°F (100°C)	Green	150°F (66°C)
87-120095-286 (B120095-286)	87-120090-286 (B120090-286)	286°F (141°C)	Blue	225°F (107°C)
87-120095-360 (B120095-360)	87-120090-360 (B120090-360)	360°F (182°C)	Mauve	300°F (149°C)
87-120095-450 (B120095-450)	87-120090-450 (B120090-450)	450°F (232°C)	Black	375°F (191°C)
87-120095-500 (B120095-500)	87-120090-500 (B120090-500)	500°F (260°C)	Black	475°F (246°C)

Note: New Thermo-Bulb Links (P/N 87-12009X-XXX) are marked "K". Old Thermo-Bulb Links (P/N B12009X-XXX)) are marked "B." It is permissible to use old and/or new Thermo-Bulb Links included in this manual in a Range Guard system.

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2-2.3.4 FUSIBLE-LINKS, TYPE ML, P/Ns WK-282661-000, WK-282662-000, W WK-282666-000 (OLD P/N B282661, B282662, B282664 AND B2826

Fusible-Links are available in various temperature ratings with a minimur 10 lb./40 lb. (5 kg/18 kg) (see Table 2-14).

Figure 2-31. Fusible-Link, P/N WK-28266X-000

Table 2-14. Fusible-Link Temperature Ratings

Fusible-Link Rating	Maximum Exposure Temperature	Color	Part Number (Old Part Number)
165°F (74°C)	100°F (38°C)	Yellow	WK-282661-000 (B282661)
212°F (100°C)	150°F (65°C)	White	WK-282662-000 (B282662)
360°F (182°C)	300°F (149°C)	Unpainted	WK-282664-000 (B282664)
500°F (260°C)	440°F (226°C)	Orange	WK-282666-000 (B282666)
Note: New type ML fusible Links (P/N WK-28266X-000) are marked "K". Old type ML fusible Links (P/N B28266X)) are marked "B." It is permissible to use old and/or new type ML fusible Links included in this manual in a Range Guard system.			

The rating temperature, which is stamped on the Fusible-Link, is the temperature at which the link will separate when new. However, continual exposure to cycling ambient temperatures may cause a degradation of the link over time.

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2-2.3.5 FUSIBLE-LINK, TYPE A, P/N 87-120060-001 (OLD P/N 9196903)

Fusible-Links are available with a minimum/maximum load rating of 3 lb. — 45 lb. (1.4 Kg — 20.4 Kg). See Table 2-15.

Table 2-15. Fusible-Link (Model RGA) Temperature Ratings

Fusible-Link Rating	Maximum Exposure Temperature	Part Number
360°F (182°C)	300°F (149°C)	87-120060-001 (9196903)
Note: New type A fusible links (P/N 87-120060-001) are marked "K ". Old type A fusible Links (P/N 9196903)) are marked "RG." It is permissible to use old and/or new type A fusible Links included in this manual in a Range Guard system.		

Figure 2-32. Fusible-Link, P/N 87-120060-001

2-2.3.6 ELECTRICAL DETECTION (DETECT-A-FIRE)

Refer to Appendix A for electrical detection (Detect-A-Fire).

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2-2.3.7 CORNER PULLEY, P/N WK-844648-900

The Corner Pulley is used to change the direction of the control cable ru
conduit (1/2-inch EMT) is attached to the Corner Pulleys with the coupling r
Pulley is equipped with a ball-bearing pulley for minimum resistance to th

Figure 2-33. Corner Pulley, P/N WK-844648-900

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2-2.3.8 TEE PULLEY, P/N 843791 (UCH ONLY)

The Tee Pulley is required when more than one Remote Manual Release (P/N B87 valves are used in the same system.

Figure 2-34. Tee Pulley, P/N 843791

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2-2.4 Remote Manual Releases

2-2.4.1 REMOTE MANUAL RELEASE, P/N B875572 (UCH ONLY)

The Remote Manual Release, shown in Figure 2-35, is provided as a means system from a remote location. The Remote Manual Release is attached tc with 1/16-inch control cable. To actuate the system at the Remote Manual I pin and pull hard on the handle.

Each Remote Manual Release is supplied with a separate nameplate. This nameplate must be attached to the mounting surface 1-inch above or below the Remote Manual Release.

Figure 2-35. Remote Manual Release, P/N B875572

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2-2.4.2 REMOTE MANUAL RELEASE PULL STATION, P/N 60-120110-001

The Remote Manual Release Pull Station, shown in Figure 2-35, is provided as a actuating the system from a remote location. The Remote Manual Release is attac Control Head (UCH) or the A+ Control Box, with 1/16-inch control cable. The Rem Pull Station is available for use in both the "un-tensioned" Pull-to-Trip and "ter Trip lines. To actuate the system at the Remote Manual Release Pull Station, pu and pull hard on the handle.

In the Pull-to-Trip mode (UCH ONLY), tension will be applied to the cable, allowing the UCH to activate the Cylinder and Valve Assembly.

In the Release-to-Trip mode, removing the safety pin will release tension from the cable, allowing the UCH or A+ Control Box to activate the Cylinder and Valve Assembly.

The Remote Manual Release Pull Station may be mounted in a recess or surface mount configuration. The assembly is packaged with all necessary components needed to install in either configuration. Mounting hardware is not included.

Each Remote Manual Release Pull Station is supplied with a choice of labels. The proper label must be attached to the faceplate so as to be easily read after installation. Applying the label after installation allows for vertical or horizontal mounting of the Remote Manual Release Pull Station.

Figure 2-36. Remote Manual Release Pull Station, P/N 60-120110-001

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2-2.4.3 SURFACE MOUNTED REMOTE MANUAL CONTROL

There are two types of Surfaced Mounted Remote Manual Releases avail
System and A+ Control Box:

- End-of-Line Surface Mounted Remote Manual Control, P/N 9197463 (
- In-Line Surface Mounted Remote Manual Control (with In-Line Kit), P/

Each is used as a means to actuate the system manually from a remote loca
by removing the pull pin, releasing the tension in the detection cable, allowing the Control Box to activate the cylinder.

If an End-of-Line Remote Manual Release is not applicable, it can be converted to an In-Line Remote Manual Release by using an In-Line Kit. Refer to the installation section of this manual. An In-Line Kit uses a Tee Pulley and Corner Pulley Bearing to modify the End-of-Line Remote Manual Release.

Refer to the installation section of this manual for installation parameters.

Note: Only use End-of-Line Remote Manual Release if no detectors are installed.

Figure 2-37. Surface Mounted End-of-Line Remote Manual Release, P/N 9197463

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2-2.4.4 RECESS MOUNTED REMOTE MANUAL CONTROL FOR A+ CONTROL BOX CONTROL BOX

The Recess Mounted Remote Manual Control provides a means to operate the sy: a remote location. It is designed to be mounted to a wall stud and is provided wi

Two types of Recess Mounted Remote Manual Controls are available:

- End-of-Line Remote Manual Control (P/N 9197461)
  — designed for use at the end of the detection line (Figure 2-38).
- In-Line Remote Manual Control (P/N 9197460)
  — designed for installation within the detection line. A Tee Pulley is included with the In-Line Remote Manual Control (Figure 2-39).

Note: Only use End-of-Line Remote Manual Release if no detectors are installed.

Figure 2-38. Recess Mounted End-of-Line, Remote Manual Release, P/N 9197461

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Figure 2-39. Recess Mounted, In-Line Remote Manual Release, P/N 9197460

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2-3 AUXILIARY COMPONENTS

2-3.1 Pneumatic Release, P/N 9189412

The Pneumatic Release can be used to release the stem of a spring loaded gas s
minimum operating pressure of 35 PSI (241 kPa). When a system discharges, pre
within the Pneumatic Release causes the piston to move, thereby retracting a r
pin. The pin is used as a support for a cable linkage to:

- Gas valve stem
- Ventilation dampers

The 1/8-inch by 1-1/2-inch pipe nipple connects the Pneumatic Release to a 12-inch riser off the agent distribution piping.

Retraction of the pin removes support for the linkage allowing it to pull away, thus releasing the valve stem which now moves to the closed position under the force of the valve closing spring.

Figure 2-40. Pressure Operated Release, P/N 9189412

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2-3.2 Pressure Switch, P/N 9197023

The Pressure Switch, P/N 9197023 (Figure 2-41), can be used in place of close electrical circuits to:

- sound an alarm
- trip a magnetic contactor to turn off the electrically operated cooking a
- operate an electric gas valve
- shut off exhaust fans

The adjustable range of the Pressure Switch is 10—100 PSI. The setpoint is factory set at 20 PSI in rise.

Note: There is no limit to the quantity of Pressure Switches in a Range Guard System.

Table 2-16. Pressure Switch (SPDT) Electrical Specifications

115/230 Vac	15 Amps
28 Vdc	5 Amps
75 Vdc	1 Amp
125 Vdc	1/2 Amp
250 Vdc	1/4 Amp
Yellow Wire	Common
Blue Wire	Normally Open
Black Wire	Normally Closed

WARNING **Electrical appliances usually have a higher amperage rating than 15 amps and must not be wired directly to the Pressure Switch. A magnetic contactor or relay must be used.**

Figure 2-41. Pressure Switch, P/N 9197023

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2-3.3 Mechanical Gas Valve, P/N B12007X

A Mechanical Gas Valve is required on systems used to protect gas-fueled applia
actuation, the control stem closes, stopping the gas flow to the appliance(s).

Note: Only Mechanical Gas Valves that are specifically UL listed and identified
this manual may be used with the Range Guard system.

Figure 2-42. Mechanical Gas Valve, P/N B12007X

Table 2-17. Mechanical Gas Valve Sizes

Pipe Size	Part Number
3/4 in. (19 mm)	B120071
1 in. (25.4 mm)	B120072
1-1/4 in. (32 mm)	B120073
1-1/2 in. (38 mm)	B120074
2 in. (51 mm)	B120075
2-1/2 in. (64 mm)	B120076
3 in. (76 mm)	B120077

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2-3.4 Electric Gas Valve, P/N 9197XXX

Electric Gas Valve (Figure 2-43) operates on (120V, 60 Hz) which powers a
open. This valve is controlled by a pressure switch or microswitch and the
See Paragraph 2-3.5.

Upon system actuation, the valve closes, stopping the gas flow to the applia
power will also cause the Electric Gas Valve to close.

See Table 2-18 for a list of the electric gas valve sizes.

All Electric Gas Valves must be installed horizontally with the solenoid up.

Note: The electric gas valve and the Manual Reset Relay must be specifically UL listed for use with the Range Guard system.

Figure 2-43. Electric Gas Valve, P/N 9197XXX

Table 2-18. Electric Gas Valve Sizes

Size	Part Number
1/2 in. (13 mm)	9197017
3/4 in. (19 mm)	9197018
1 in. (25 mm)	9197019
1-1/4 in. (32 mm)	9197020
1-1/2 in. (38 mm)	9197021
2 in. (51 mm)	9197022
2-1/2 in. (64 mm)	9197444
3 in. (76 mm)	9197445

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2-3.5 Manual Reset Relay for Electric Gas Valve, P/N 9101735

The Manual Reset Relay Box (Figure 2-44 and Figure 2-45) provides DPDT conta
at 115 Vac and prevents immediate reopening of the Electric Gas Valve (P/N 919
shows the Manual Reset Relay Box used before 2006.

Note: The Electric Gas Valve and the Manual Reset Relay must be specifically U
the Range Guard system.

Figure 2-44. Manual Reset Relay Box, P/N 9101735

Figure 2-45. Manual Reset Relay Box, P/N 9101735 (Used Before 2006)

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2-3.6 EMT and O-Ring Connector Kit, P/N B120058

If using more than the three EMT connectors supplied with the UCH Cont
EMT Connector and O-Ring Connector Kit.

Figure 2-46. EMT and O-Ring Connector Kit, P/N B120058

2-3.7 1/16-inch Control Cable, P/N 219649

The Control Cable used in the system is stainless-steel, 1/16-inch O.D., 7x7 stranded cable. The control cable runs from the various system devices, through 1/2-inch EMT conduit, to the UCH or A+ Control System.

Table 2-19. 1/16-inch Control Cable

Part Number	Description
219649	1/16, 7x7 Cable, Stainless Steel, Reel of 500 ft. (152 m)

2-3.8 Crimp Sleeve, P/N 214951

In order to ensure that a crimp sleeve is secure, the cable must always be looped so that there are two lengths of cable inside the Crimp Sleeve before crimping. Cable must not be spliced anywhere along its length.

Figure 2-47. Crimp Sleeve, P/N 214951

Table 2-20. Crimp Sleeve

Part Number	Description
214951	Cable Crimp Sleeve (order in package of 50 only)
9197288	Cable Crimp Sleeve (package of 50 of 214951)

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2-3.9 "S" Hooks, P/N 9189413

"S" Hooks are used to attach the Fusible-Link to the 1/16-inch. cable leading t System.

Figure 2-48. "S" Hook, P/N 9189413

Table 2-21. "S" Hook

Part Number	Description
9189413	"S" Hook (order in package of 50 only)
9187287	"S" Hook (package of 50 of 9189413)

2-3.10 Crimping Tool, P/N 253538

The Crimping Tool (P/N 253538), shown in Figure 2-49, is used in conjunction with Crimp Sleeves. Wherever the system 1/16-inch Control Cable must be looped or terminated, the Crimp Sleeves and Crimping Tool must be used.

Note: Splicing of the 1/16-inch Control Cable is not permitted. Other Crimping Tools are not authorized.

Figure 2-49. Crimping Tool, P/N 253538

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2-3.11 1/2-inch Vent Plug, P/N 9196984

A 1/2-inch Vent Plug is used in the discharge piping near a Range Guard cy
build-up in the discharge pipe system, caused by heat, from rupturing the

The 1/2-inch Vent Plug is to be installed in the discharge piping so that it fa

CAUTION **NEVER INSTALL IT FACING DOWN OR AT THE FLOOR.**

Figure 2-50. 1/2-inch Vent Plug, P/N 9196984

2-3.12 Keeper Pin, P/N 9197108

The Keeper Pin (P/N 9197108) is used to prevent actuation while installing the system.

Figure 2-51. Keeper Pin, P/N 9197108

2-3.13 System Recharge

For recharge purposes, select the size of the Karbaloy agent recharge container (see Table 2-22) that fits the cylinder.

Table 2-22. Wet Chemical Agent

Part Number	Old Part Number	Wet Chemical
87-120030-001	9197428	RG-1.25G Wet Chemical Recharge Container
87-120031-001	9197257	RG-2.5G Wet Chemical Recharge Container
87-120032-001	9196991	RG-4GS/RG-4GM Wet Chemical Recharge Container
87-120033-001	9196783	RG-6G Wet Chemical Recharge Container

Note: It is permissible to use old and/or new recharge containers included in this manual in a Range Guard system.

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CHAPTER 3
SYSTEM DESIGN

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3-1 INTRODUCTION

This chapter introduces the designer and installer to the process whereby Range Guard® Wet Chemical Systems are designed. It outlines the process, introduces the limitations imposed on design by system hardware, as well as those mandated by performance considerations.

As the designer becomes familiar with this material, they should remember that analysis and design is a careful, step-by-step process. All steps must be followed, none can be omitted, and all unique aspects of a given application must be taken into account if the resulting fire-suppression system is to deliver the desired results.

All systems must be designed in accordance with the latest edition of NFPA Standard 17A, "Standard for Wet Chemical Systems", and other applicable NFPA standards. All configurations are UL and ULC/ORD 1254.6 Listed to Underwriters Laboratories 300, 1994 Edition, unless otherwise noted.

3-2 DESIGN PROCEDURE

This section covers the design aspects of the Karbaloy systems. It contains all the necessary information to design a complete system including nozzle placement, detector placement, cylinder sizing, piping limitations and auxiliary hardware.

3-2.1 General Design Procedure

Analysis and design should be approached as a methodical process, and performed step-by-step. Only when all the steps are followed is the resulting system likely to perform as desired. If any step is omitted, it is probable that the system will not function as well as it should. The steps in the analysis and design process are:

- Hazard analysis
- Nozzle selection, number and location
- Cylinders (Number, size, and location of cylinders)
- Detector selection
- Piping layout
- Auxiliary requirements

3-2.1.1 HAZARD ANALYSIS

Sketch out the kitchen exhaust hood and appliances, taking note of the path of egress for remote pull station location, discuss with owner the placement of cylinders and control heads, automatic fuel shut down device locations, and any power shutdowns required.

Consult NFPA 17A and 96 for design guidelines. Record the following and include in your sketch:

- Size of exhaust hood(s) and exhaust duct opening(s)
- Size and fuel type of appliances (take note if open flames are sufficiently separated from combustible cooking media)
- Size of gas line(s) feeding appliances
- Building or local alarms

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- Make up air or auxiliary equipment
- Are the correct hand portable fire extinguishers present or are additional ext

3-2.1.2 NOZZLE SELECTION AND LOCATION

Select the number and type(s) of nozzle(s) needed and locate them so that t covered. Use the coverage/distribution specifications for each nozzle type to deter discharge nozzles required to deliver the necessary quantity of wet chemical give appropriate to the hazard.

3-2.1.3 CYLINDER DETERMINATION (NUMBER, SIZE, AND LOCATION OF CYLINDER(S))

Determine the number of nozzles required, whether additional agent or nozzles may be needed, and select the cylinder which will supply the needed amounts wet chemical. After determining the quantity and types of wet chemical needed to control the hazard itself, determine whether any special conditions necessitate additional wet chemical quantities and/or nozzles. For example, it may be necessary to adjust the agent discharge rate in order to offset the effects of ventilation, or it may be necessary to screen openings in an enclosure to prevent wet chemical leakage through those openings.

3-2.1.4 DETECTOR SELECTION

Detector selection will depend on the response speed required, the probable heat level and rate of spread of the fire. The detectors sense the heat energy released by the combustion of fuel and oxygen. Upon detection of a fire, the detection system sends a signal to the system control head(s) which initiates the wet chemical discharge. The most commonly used detectors are the:

1. Fixed-temperature thermo-bulb or fusible link
2. Fixed-temperature rate-compensated thermostat

3-2.1.5 PIPING LAYOUT

Careful piping layout assures that the agent reaches the distribution nozzles appropriately, and that piping parameters are not exceeded. These parameters involve pipe lengths, the number of elbows, and other factors such as the allowable distances (equivalent/feet) from Cylinder and Valve Assembly. These parameters are discussed in detail in the design examples in Paragraph 3-8.

3-2.1.6 AUXILIARY REQUIREMENTS

Controls are required to turn off force-draft ventilation systems, fuel (or combustible-liquid) pumps, conveyors, and so on.

3-3 DESIGNING FOR APPLIANCE PROTECTION

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To determine the number and size of cylinders required for each system, used. A flow number is assigned to each type of nozzle used in the Rang relative indicator of the discharge rate of each nozzle. Refer to Table 3-1 appliance.

ADP nozzles have a flow number of one. The ADP nozzle is used to pr appliances. These appliances are solid fuel charbroilers, upright broilers, low proximity Split Vat Deep Fat Fryers, griddles and chain broilers. Additionally, the ADP nozzle is used to protect the duct and plenum areas of the hood.

The 'F' nozzle has a flow number of two and is used to protect fryers and lava rock broilers.

The 'R' nozzle has a flow number of one and is used to protect a burner range.

The GRW nozzle has a flow number of one and is used to protect a radiant charbroiler or a wok.

The LPF nozzle has a flow number of two and is used to protect a deep fat fryer requiring a low nozzle height.

The LPR nozzle has a flow number of one and is used to protect a four burner range requiring a low nozzle height (e.g. range with a backshelf or an integral broiler).

The DM nozzle has a flow number of three and is used to protect the mesquite log charbroiler.

After completing your design for locating nozzles over the cooking appliances to be protected, determine the total of the flow numbers required, including those for the plenum and exhaust duct(s). This will render the required cylinder size for the total number of flow points.

Note: Protection of combination appliances requires a separate nozzle for each appliance.

CAUTION

While nozzles can be placed anywhere in the areas denoted in the following sections, caution should be exercised regarding placement and aiming of nozzles from the back of the appliance toward appliance operators.

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3-3.1 Nozzle Height

Depending on the type of appliance, measurement of the nozzle height is to be nozzle to the top of the appliance or cooking surface (see Figure 3-1 for example). for nozzle requirements for specific appliances. When using the grid style nozzle height is measured from the nozzle tip to the aiming point. When using perimeter the nozzle height is measured from the nozzle tip straight down to the appliance

EXCEPTION: Woks are measured to the inside bottom of the wok.

3-3.2 Nozzle Aim

Correct aiming of the appliance nozzles is extremely important to the performance of the system. Care should be taken to insure accurate aiming and that the conical spray from the nozzle is not obstructed. Aiming must comply with the parameters outlined in the design section of this manual.

3-3.3 Hazard Area

The hazard area is the actual size of the portion of the appliance which can be used for cooking. The physical width of an appliance does not represent the width of the hazard area. The thickness of the appliance wall must be deducted to arrive at the hazard area width.

CAUTION **All appliances being protected must be shut off automatically upon system actuation.**

The appliance area is the size of the appliance that includes the cooking area (fry pot or vat) and the integral drip board area.

Figure 3-1. Examples of Hazard Areas for Typical Appliances

3-4 APPLIANCES

Table 3-1 lists the various appliances and nozzle type used to protect that

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Table 3-1. Appliance References

Appliance	Reference	N	
Deep Vat Fryer			
Single Vat Deep Fryer with Drip Boards	Paragraph 3-4.1	F	2
18-1/2 in. x 24-1/2 in. Deep Fat Fryer	Paragraph 3-4.2	(2) F	4
Split Vat Deep Fat Fryer	Paragraph 3-4.3	F	2
14 in. x 14 in. (356 mm x 356 mm) Deep Fat Fryer	Paragraph 3-4.4	F	2
Single Vat Deep Fryer with Drip Boards less than 1 in. (25 mm)	Paragraph 3-4.5	F	2
Split Vat Deep Fat Fryer (Low Proximity)	Paragraph 3-4.6	ADP	1
Deep Fat Fryer (Low Proximity)	Paragraph 3-4.7	LPF	2
Krispy Kreme Model 270 d/h Doughnut Fryer	Paragraph 3-4.8	ADP	1
Ranges			
Four-Burner Range	Paragraph 3-4.9	R	1
Two-Burner Range	Paragraph 3-4.10	R	1
Single Burner Range	Paragraph 3-4.11	R	1
Four-Burner Range	Paragraph 3-4.12	LPR	1
Broilers			
Upright Broilers	Paragraph 3-4.13	ADP	1
Charbroilers (Lava, Pumice, Ceramic, or Synthetic Rock)	Paragraph 3-4.14	F	2
Gas Radiant/Electric Charbroiler	Paragraph 3-4.15	GRW	1
Natural or Mesquite Charcoal Charbroiler	Paragraph 3-4.16	ADP	1
Mesquite Logs Charbroiler	Paragraph 3-4.17	DM	3
Chain Broiler (Closed-Top)	Paragraph 3-4.18	ADP	1
Chain Broiler (Open-Top)	Paragraph 3-4.19	ADP	1
Griddle - Flat Cooking Surface	Paragraph 3-4.20	ADP	1
Wok	Paragraph 3-4.21	GRW	1
Tilt Skillets (Braising Pans)	Paragraph 3-4.22	F	2

3-4.1 Single Vat Deep Fat Fryer With Drip Boards

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Table 3-2. F Nozzle Coverage Area

Items	Parameters
Maximum Hazard Area	18 in. x 18 in. (457 mm x 457 mm)
Maximum Appliance Area (with drip board)	18 in. x 23 in. (457 mm x 584 mm)
Nozzle Aim	Midpoint of hazard area
Nozzle Location (from top of appliance at an angle of 45° or more from the horizontal)	27 in. (686 mm) Min. 45 in. (1143 mm) Max.

Figure 3-2. Single Vat Deep Fat Fryer

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3-4.2 18-1/2 in. x 24-1/2 in. Deep Fat Fryer With Drip Board

Table 3-3. F Nozzle Coverage Area

Items	Param
Maximum Hazard Area	18-1/2 in. x 18 in. (470 mm x
Maximum Appliance Area (with drip board)	18-1/2 in. x 24-1/2 in. (470 mm x 622 mm)
Nozzle Aim	Midpoint of module area per nozzle
Nozzle Location (at an angle of 45° or more from the horizontal above each module)	27-1/2 in. (699 mm) Min. 45 in. (1143 mm) Max.
Module Area (half of hazard area)	18-1/2 in. x 9 in. (470 mm x 229 mm)

Figure 3-3. 18-1/2 in. x 24-1/2 in. (470 mm x 622 mm) Deep Fat Fryer

3-4.3 Split Vat Deep Fat Fryer

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Table 3-4. F Nozzle Coverage Area

Items	Parameters
Maximum Hazard Area	14 in. x 15 in. (356 mm x 381 mm)
Maximum Appliance Area (with drip board)	14 in. x 21 in. (356 mm x 533 mm)
Nozzle Aim	Midpoint of module area per nozzle
Nozzle Location (at an angle of 45° or more from the horizontal above each module)	27 in. (686 mm) Min. 45 in. (1143 mm) Max.

Figure 3-4. Split Vat Deep Fat Fryer

3-4.4 14 in. x 14 in. (356 mm x 356 mm) Deep Fat Fryer

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Table 3-5. F Nozzle Coverage Area

Items	Parar
Maximum Hazard Area	14 in. x 14 in. (356 mm x
Maximum Appliance Area (with drip board)	14 in. x 24-1/2 in. (356 mm x 622 mm)
Nozzle Aim	Midpoint of hazard area
Nozzle Location (from top of appliance at an angle of 45° or more from the horizontal)	27-1/2 in. (686 mm) Min. 45 in. (1143 mm) Max.

Figure 3-5. 14 in. x 14 in. (356 mm x 356 mm) Deep Fat Fryer

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3-4.5 Single Vat Deep Fat Fryer (with Dripboards less than 1 in. [25 mm])

Table 3-6. F Nozzle Coverage Area

Items	Parameters
Maximum Hazard Area	24 in. x 24 in. (610 mm x 610 mm)
Maximum Appliance Area (with drip board)	24 in. x 25 in. (610 mm x 635 mm)
Nozzle Aim	Midpoint of hazard area
Nozzle Location (at any point on or within the perimeter of the hazard area)	27-1/2 in. (699 mm) Min. 46 in. (1168 mm) Max.

Figure 3-6. Single Vat Deep Fat Fryer (with Dripboards less than 1 in. (25mm)

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3-4.6 Split Vat Fryer (Low Proximity Application)

Table 3-7. ADP Nozzle Coverage Area

Items	Parameter
Maximum Hazard Area	14 in. x 15 in. (356 mm x 381 mm)
Maximum Appliance Area (with drip board)	14 in. x 21 in. (356 mm x 533 mm)
Nozzle Aim	Midpoint of hazard area
Nozzle Location (at any point on or within the perimeter of the hazard area)	16 in. (406 mm) Min. 27 in. (686 mm) Max.

Figure 3-7. Split Vat Fryer (Low Proximity Application)

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3-4.7 Low Proximity Nozzle for Deep Fat Fryer

Table 3-8. LPF Nozzle Coverage Area

Items	Parameters
Maximum Hazard Area	14 in. x 15-1/2 in. (356 mm x 394 mm)
Maximum Appliance Area (with drip board)	14 in. x 23-1/4 in. (356 mm x 591 mm)
Nozzle Aim	Midpoint of appliance area (includes drip board)
Nozzle Location (top of appliance) See Table 3-9 for Nozzle Offset Information and Table 3-10 for minimum pipe length to prevent splash from the cylinder to a LPF Nozzle protecting a fryer.	12 in. (305 mm) Min. — offset from center shall not exceed 3-1/2 in. (89 mm) 24 in. (610 mm) Max. — offset from center shall not exceed 13-1/2 in. (343 mm)

Table 3-9. Nozzle Offset At Given Heights

Nozzle Tip Height	Distance From Center
12 in. (305 mm)	3-1/2 in. (89 mm)
14 in. (356 mm)	5-13/64 in. (132 mm)
16 in. (406 mm)	6-13/16 in. (173 mm)
18 in. (457 mm)	8-1/2 in. (216 mm)
20 in. (508 mm)	10-13/64 in. (259 mm)
22 in. (559 mm)	11-13/16 in. (300 mm)
24 in. (610 mm)	13-1/2 in. (343 mm)

Table 3-10. Pipe Limitations for LPF Nozzle

Pipe Size	Minimum Pipe From Cylinder Discharge Port to First LPF Nozzle Linear Pipe & Fittings	Minimum Number of Flows in Complete System	Minimum Total Pipe Required For All Remaining Nozzles Beyond the First LPF Nozzle Linear Pipe & Fittings
1/2 in.	7-1/2 ft. (2 m) and (1) Bull Tee	8	7 in. (178 mm) and One Full Tee (Run and Bull Connections)
3/4 in. and 1 in.[1]	11 Equivalent Feet (3 m) of 1/2 in. Pipe	8	5-13/64 Equivalent Feet (1.6 m) of 1/2 in. Pipe

[1] For pipe sizes larger than 1/2-inch, use the formulae below for the equivalent length as measured in 1/2-inch pipe.

1 foot (0.3 meter) of 3/4-inch (19 mm) pipe equals 0.254 equivalent feet of 1/2-inch (13 mm) pipe.

1 foot (0.3 meter) of 1-inch (25 mm) pipe equals 0.079 equivalent feet of 1/2-inch (13 mm) pipe.

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Figure 3-8. Low Proximity Nozzle for Deep Fat Fryer (LPF)

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3-4.8 Krispy Kreme Model 270 d/h Doughnut Fryer

Eight ADP nozzles (P/N B120011), are dedicated to protect this appliance.

Table 3-11. Eight ADP Nozzles Coverage Area

Items	Parameters
Maximum Depth (front-to-back)	33 in. (840 mm)
Maximum Length (left-to-right)	93 in. (2362 mm)
Nozzle Location (lined up on both sides of the appliance, front and back outside perimeter of the cooking area	3-1/2 inches (89 mm) Min. 6-1/2 in. (165 mm) Max.
Nozzle Height (measured from the top of the appliance to the tip of the nozzle)	22-1/2 in. (572 mm) Min. 29-1/2 in. (749 mm) Max.
Maximum Module (aiming points is the centerline of the hazard area — center of each module of the unit)	33 in. (838 mm) x 23-1/4 in. (591 mm)

Figure 3-9. Krispy Kreme Model 270 d/h Doughnut Fryer

System must use a complete six-gallon RG-600 cylinder for proper protection. Maximum piping limitations can be taken from the listed RG-600 cylinder size piping parameters (see Table 3-12).

The minimum pipe length, to prevent splash, that is required between cylinder and closest cooking appliance nozzle is listed below.

Table 3-12. Krispy Kreme Model 270 d/h Doughnut Fryer Minimum Pipe Length

Piping Size	Minimum Allowable Pipe
1/2 in. (13 mm)	39 Equivalent feet
1/2 in. (13 mm)	27 Linear feet

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3-4.9 Four Burner Ranges

Table 3-13. R Nozzle Coverage Area — Four Burner Range

Items	Parameter
Maximum Hazard Area	28 in. x 28 in. (711 mm x 711 m
Nozzle Aim	Midpoint of Hazard Area
Nozzle Location — Anywhere within the area of a circle generated by a 9 in. (229 mm) radius about the midpoint **Note:** Shape of burner not important.	20 in. (508 mm) Min. 42 in. (1067 mm) Max.

Figure 3-10. R Nozzle Coverage for a 4-Burner Range

3-4.10 Two Burner Ranges

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Table 3-14. R Nozzle Coverage Area — Two Burner Range

Items	Parameters
Maximum Hazard Length	28 in. (711 mm)
Nozzle Aim	Midpoint of hazard area
Nozzle Location - Anywhere within the area of a circle generated by a 9 in. (229 mm) radius about the midpoint **Note:** Shape of burner not important.	20 in. (508 mm) Min. 42 in. (1067 mm) Max.

Figure 3-11. R Nozzle Coverage for a 2-Burner Range

3-4.11 Single Burner Range

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Table 3-15. R Nozzle Coverage Area — Single Burner Range

Items	Parameter
Nozzle Aim	7 in. (178 mm) from center of bu
Nozzle Location — Anywhere within the area of a circle generated by a 9 in. (229 mm) radius about the aim point. **Note:** Shape of burner not important.	20 in. (508 mm) Min. 42 in. (1067 mm) Max.

Figure 3-12. R Nozzle Coverage for a 1-Burner Range

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3-4.12 Four Burner Ranges (LPR), P/N B120024

The low proximity range top coverage provides protection for a range top that h broiler integral to the regular range.

Table 3-16. LPR Nozzle Coverage Area — Four Burner Range

Items	Parameters
Maximum Hazard Area	24 in. x 24 in. (610 mm x 610 mm)
Nozzle Aim	Midpoint of hazard area
Nozzle Location — **Dimension A in Figure 3-13**	Refer to Table 3-17

Table 3-17. LPR Nozzle Parameters

Burner Spacing Centerline to Centerline (Dimension B in Figure 3-13) **Note:** Shape of burner not important.	**Nozzle Height (Dimension A) (centrally over the range and under shelf/broiler)**
14 in. (356 mm)	16 in. (406 mm) Min. 20 in. (508 mm) Max.
Between 12 in. and 14 in.(305 mm and 432 mm)	16 in (406 mm) Min. 17 in (432 mm) Max.
Between 10 in. and 12 in. (254 mm and 305 mm)	16 in. (406 mm)

Figure 3-13. LPR Nozzle Coverage for a 4-Burner Range (LPR)

The minimum pipe length to prevent splash from the cylinder to a LPR nozz
is defined in Table 3-18.

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Table 3-18. Piping Parameters

1	Minimum length to LPR nozzle — linear: 9 ft. (2.7 m)
2	Minimum length to LPR nozzle — equivalent: 12 ft. (3.6 m)
3	Minimum total length in system — linear: 11.08 ft. (3.4 m)

Note: If the LPR nozzle is disassembled for inspection or cleaning, reassemble the disc/core unit with the center core 'nub' facing upstream. The flat side should face towards the threaded nozzle cap. Refer to Figure 3-14.

Figure 3-14. LPR Nozzle Assembly

3-4.13 Upright Broilers

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Table 3-19. ADP Nozzle Coverage Area

Items	Parameters
Broiler Compartment With Maximum Internal Horizontal Dimensions	30-1/4 in. x 34 in. (768 mm x 864 mm)
Nozzle Aim	Through grill toward the center of the grease drain-off opening
Nozzle Location	Within the top 4 in. (102 mm) of space in the broiler compartment. Commonly mounted near the front opening and directed inside the broiler

NOTE: DIMENSIONS SHOWN ARE INSIDE BROILER COMPARTMENT

ADP NOZZLES SHOULD BE MOUNTED ON THE PERIMETER OF THE BROILER TOP (SHADED AREA). IT SHOULD BE DIRECTED THROUGH THE GRILL TOWARD THE CENTER OF THE GREASE DRAIN-OFF OPENING. NOZZLE DISCHARGE SHALL NOT BE OBSTRUCTED BY ANY STRUCTURAL PART OF THE BROILER.

Figure 3-15. ADP Nozzle Placement for Upright Broilers

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Table 3-20. F Nozzle Coverage Area

Items	Parameter
Maximum Appliance Area (maximum of two layers of lava, pumice, or stone)	22 in. x 23 in. (559 mm to 584 m
Nozzle Aim	Midpoint of the hazard area
Nozzle Location (at an angle of 45° or more from the horizontal above grate area)	24 in. (610 mm) Min. 48 in. (1219 mm) Max.

Figure 3-16. Lava, Pumice, Ceramic, or Synthetic Rock Charbroiler

3-4.15 Gas Radiant/Electric Charbroiler

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Table 3-21. GRW Nozzle Coverage Area

Items	Parameters
Maximum Cooking Surface	21 in. x 24 in. (533 mm to 610 mm)
Nozzle Aim	Midpoint of the hazard area above cooking surface
Nozzle Location (located at an angle of 45° or more from the horizontal)	24 in. (610 mm) Min. 48 in. (1219 mm) Max.

Figure 3-17. Gas Radiant/Electric Charbroiler

3-4.16 Natural or Mesquite Charcoal Charbroiler

The depth of mesquite charcoal pieces or charcoal is limited to 6 in. (152 logs or wood are not acceptable.

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Table 3-22. ADP Nozzle Coverage Area

Items	Parameters
Maximum Cooking Surface	24 in. x 24 in. (610 mm x 610 mm)
Nozzle Aim	Midpoint of the hazard area above cooking surface
Nozzle Location (at an angle of 45° or more from the horizontal)	24 in. (610 mm) Min. 48 in. (1219 mm) Max.

Figure 3-18. Natural or Mesquite Charcoal Charbroiler

3-4.17 Mesquite Logs Charbroiler

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Table 3-23. DM Nozzle Coverage Area

Items	Parameters
Maximum Cooking Surface **Note:** If the charbroiler has a blower, it shall be shut off when the Range Guard system operates.	30 in. x 24 in. (762 mm x 610 mm)
Nozzle Aim	Midpoint of the hazard area above cooking surface
Nozzle Location (located at an angle of 45° or more from the horizontal)	24 in. (610 mm) Min. 48 in. (1219 mm) Max.
Mesquite wood charbroiler may use wood chips, chunks, logs (or any combination thereof). The natural-charcoal/mesquite-charcoal charbroiler may use charcoal.	Depth of 10 in. (254 mm) Max.

Figure 3-19. Mesquite Logs Charbroiler

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Table 3-24. Single ADP Nozzle Coverage Area

Items	Parameter
Maximum Internal Horizontal Dimensions	28 in. x 29 in. (711 mm x 737 mm)
Nozzle Location (centered vertically in the chain broiler tunnel space above the chain)	Positioned at one corner of the chain broiler tunnel aimed at opposite diagonal of the tunnel.
Pipe drop and fittings	1/4 in. (6 mm)

Figure 3-20. ADP Nozzle Installation for Closed Top Chain Broiler

3-4.19 Chain Broiler (Open-Top)

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Table 3-25. Dual ADP Nozzle Coverage Area

Items	Parameters
Maximum Internal Broiler Tunnel Dimensions	28 in. x 29 in. (711 mm x 737 mm)
Maximum External Top Dimensions	28 in. x 29 in. (711 mm x 737 mm)
First Nozzle Location	Located at one corner of the chain broiler tunnel and aimed toward the opposite diagonal corner of the tunnel — spaced 1-inch (25 mm) back from the tunnel opening.
Second Nozzle Location (centered over the top opening of chain broiler) from the top surface	12 in. (305 mm) Min. 48 in. (1219 mm) Max.
Drop pipe and fittings to the chain broiler	1/4 in. (6 mm)

Figure 3-21. ADP Nozzle Installation for Open-Top Chain Broiler

CAUTION

The second nozzle must be used when there is any exhaust opening on the top of the appliance.

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3-4.20 Griddle — Flat Cooking Surface (With or without Raised Ribs)

Table 3-26. ADP Nozzle Coverage Area

Items	Parameter
Maximum Hazard Area	30 in. x 42 in. (762 mm x 1067 m
Nozzle Aim	At a point 3 in. (76 mm) from the midpoint of hazard area
Nozzle Location — **any point on the perimeter of appliance**	13 in. (330 mm) Min. 48 in. (1219 mm) Max. **Note:** Positioning the nozzle directly over the appliance is not permitted.

Figure 3-22. Griddle - Flat Cooking Surface

3-4.21 Wok

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Table 3-27. GRW Nozzle Coverage Area

Items	Parameters
Wok Diameter	14 in. to 28 in. (356 mm to 1829 mm)
Wok Depth	3 in. to 8 in. (76 mm to 508 mm)
Nozzle Aim	Center of Wok
Nozzle Location — Must be over center and within 2 in. (51 mm) from center and nozzle height must be measured over center and within 2 in. (51 mm) from center from inside bottom of Wok. Only one nozzle per Wok.	35 in. (889 mm) Min. 56 in. (1422 mm) Max.

Figure 3-23. Wok

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Table 3-28. F Nozzle Coverage Area

Items	Parameter
Maximum Hazard Area	24 in. x 24 in. (610 mm x 610 mm
Nozzle Aim	Midpoint of hazard area and placed so it does not interfere with appliance operation
Nozzle Location — At the front perimeter line of the appliance	27-1/2 in. (699 mm) Min. 46 in. (1168 mm) Max. **Note:** Appliance cover cannot interfere with distribution of agent from the nozzle.

THE NOZZLE IS TO BE PLACED TOWARD THE FRONT OF THE APPLIANCE TO MINIMIZE THE POTENTIAL FOR THE SKILLET OR BRAISING PAN COVER TO INTERFERE WITH THE NOZZLE DISCHARGE.

Figure 3-24. Tilt Skillet (Braising Pan)

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3-5 MODULE PROTECTION (MULTIPLE NOZZLES)

For non-fryer appliances that exceed single nozzle coverage, multiple nozzles ca
the appliance by modularizing (dividing up into smaller sections) the larger haza

For a deep fat fryer that exceeds single nozzle coverage, multiple nozzles can be
hazard area into smaller modules that meet the limitations of a single nozzle. Hov
the maximum allowable total cooking area of 6 ft.^{2} (1.9 m^2) for any fryer using n

3-5.1 Example — Module Protection of Fryers With Dripboards Less Than 1 in. (25 mm)

Each module that the larger hazard area is divided into, must not exceed 24 in. x 24 in. (610 mm x 610 mm) and appliance area of 24 in. x 25 in. (610 mm x 635 mm) if a drip board is included. A single F nozzle is then used to protect each of these smaller modules. See Figure 3-25. The nozzle shall be located anywhere **within** the perimeter of the hazard area, and aimed at the midpoint of the hazard.

Figure 3-25. Example of Modular Protection, Single Vat Deep Fat Fryer (Less than 1-inch Dripboard)

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NOZZLE CAN BE PLACED ANYWHERE WITHIN THE SHADED AREA DIRECTLY OVER THE MODULE THAT IS BEING PROTECTED BY THE NOZZLE.

Figure 3-26. Nozzles for Deep Fat Fryer

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3-5.2 Example — Single Vat Deep Fat Fryer — With Dripboards 1 in. (25 mm) to 6

Each module that the larger hazard is divided into, must not exceed 18 in. x 18 (457 mm x 457 mm) and an appliance area of 18 in. x 23 in. (457 mm x 584 m included. A single F nozzle is then used to protect each of these smaller modules

Figure 3-27. Example of Nozzle Position (Typical for each module) for Multiple Nozzle Coverage

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3-6 VENTILATION

3-6.1 Plenums

Table 3-29. Plenum Protection

Items	Parameters	AD
No Filter [1]	10 ft. x 4 ft. (3 m x 1.2 m) Max.	1 - located at one end of the plenum
"V" Filter	10 ft. x 4 ft. (3 m x 1.2 m) 20 ft. x 4 ft. (6 m x 1.2 m)	1 - located at one end of the plenum 2 - located at end of plenum pointing inwards
Single Bank Filter	10 ft. x 4 ft. (3 m x 1.2 m) 20 ft. x 4 ft. (6 m x 1.2 m)	1 - located at one end of the plenum 2 - located at end of plenum pointing inwards

[1] When no filters are present, the nozzle protecting the plenum is used to discharge the wet chemical on the underside of the hood. In this case, the hood may not exceed a length of 10 ft. (3 m) or a width of 4 ft. (1.2 m).

Plenums larger than 10 ft. (3.0 m) x 4 ft. (1.2 m) may be protected by adding additional ADP nozzles for each additional 10 ft. (3.0 m) of plenum length and each additional 4ft. (1.2 m) of plenum width. Nozzles may be installed pointing in the same direction, and/or at the ends of the plenum pointing toward each other (see Figure 3-28). Each nozzle will provide coverage for a maximum of 10 ft. (3 m) of plenum length and 4 ft. (1.2 m) of plenum width.

ADP nozzles must be centrally located in the plenum with their discharge directed along the length of the plenum and located in relation to the filters as shown in Figure 3-28. Refer to Figure 3-28 for filter height.

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"V" FILTER BANK COVERAGE
10 ft. (3 m) PLENUM

"V" FILTER BANK COVERAGE
20 ft. (6 m) PLENUM

"V" FILTER BANK
COVERAGE (END VIEW)

SINGLE FILTER BANK COVERAGE
10 ft. (3 m) PLENUM

SINGLE FILTER BANK COVERAGE
20 ft. (6 m) PLENUM

SINGLE BANK FILTER
COVERAGE (END VIEW)

Figure 3-28. ADP Protection Nozzle, P/N B120011

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3-6.1.1 DUCTS

The ADP nozzle, P/N 87-120011-001, is used for protection of the exhaust

The duct cross section can be any shape, not including obstructions rectangular) and the duct itself can be of unlimited length. In accordance v fan should be left running at the time of system discharge. This will help tc airborne materials and gases from the hazard area in the event of a fire. Having Jurisdiction for local requirements. A damper, if present, shoul discharge. However, if the damper is closed, the system designer must insure that additional nozzles are required.

3-6.1.1.1 Protection of Ducts 0 to 50 inches in Perimeter

One ADP nozzle, P/N 87-120011-001, is required for protection of a duct with a perimeter up to 50-inches (refer to Figure 3-29). Length of duct is unlimited.

The nozzle is located at the geometric center of the cross-sectional area that it is protecting, and is located in the duct within six inches of the entrance.

Note: All Range Guard systems are listed by UL and ULC for use with the exhaust fan either on or off when the system is discharged.

Figure 3-29. Duct Protection Using Single ADP Nozzle, P/N 87-120011-001

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3-6.1.1.2 Ducts 50 to 100 inches in Perimeter

Two ADP nozzles, P/N 87-120011-001, pointing in the same direction are requir ducts with perimeters greater than 50 inches and less than or equal to 100 incl unlimited length (refer to Figure 3-30).

For other option of ducts up to 75 perimeter inches (See Figure 3-32).

Note: All Range Guard systems are listed by UL and ULC for use with the exhaust fan either on or off when the system is discharged.

Figure 3-30. Duct Protection Using Two ADP Nozzles, P/N 87-120011-001

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3-6.1.1.3 Designing For Large Ducts

Large Ducts (Perimeters Greater than 100 Inches)

For ducts larger than 100 in. (2540 mm) perimeter, the total perimeter of by 50. If the answer contains a decimal (or fraction), it must be rounde number. That will provide the number of nozzles necessary for proper p diagonal dimension (nozzle to corner of duct) of each module must not mm). If this diagonal dimension is exceeded, additional module divisions diagonal dimension is not exceeded. A nozzle must then be centered in each "module" (refer to Figure 3-31).

EXAMPLE

You have a duct with a perimeter of 156 in. (3962 mm).

Take the perimeter: **156** and divide it by the maximum allowable perimeter of a single nozzle: **50**.

$$156/50 = 3.12$$

Round the **3.12** up to the next highest integer: 4. Four nozzles are required to protect this duct.

$A^2 + B^2 = C^2$ Where A is length, B is width and C is diagonal.

Each "section" of the duct is 18L x 15W.

$$18^2 + 15^2 = C^2$$

$$324 + 225 = 549$$

The square root of 549 is 23.43 inches (23.43= 549); therefore, the diagonal of each module is 23.43 inches. One-half of 23.43 is 11.71, which is the measurement from the nozzle to the corner of the duct. Our maximum allowable diagonal is 11.78 inches, as stated above.

Figure 3-31. Modular Protection of Large Ducts

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Alternative Method: Ducts 0 to 75 Inches in Perimeter

Two ADP nozzles can be used in ducts with a perimeter of 0 up to 75 inches (165
ratio of the longest to shortest perimeter sides shall not exceed 3 to 1.

One of these nozzles is pointed into the duct and the other is pointed into the pl

The tip of the upper nozzle, of the pair of nozzles required for each duct, shall l
center of the duct opening and above the plane of the hood-duct opening betwee
24 in. (610 mm). The duct length is unlimited. See Figure 3-32.

Note: When a damper is present at the hood duct opening, the duct nozzles are to be located above the damper and should not interfere with the operation of the damper.

Note: All Range Guard systems are listed by UL and ULC for use with the exhaust fan either on or off when the system is discharged.

Figure 3-32. Optional Duct Nozzle Placement

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3-6.1.1.4 Upper/Lower Plenum Examples

Protection of special or unique plenum arrangements should be review
Having Jurisdiction). Badger recommends that upper/lower plenum arra
shown below.

Note: All Range Guard systems are listed by UL and ULC for use with th
off when the system is discharged.

1. If risers are less than 6 in. (152 mm), nozzles are required to pro
plenums and in the main exhaust duct. (See Figure 3-33 and Figure 3-34).

Example 1 — Riser less than 6 in. (152 mm) in Length

Figure 3-33. Special Plenum Arrangements

2. If risers are 6 in. (152 mm) or longer, the risers become the exhaust ducts and there is no upper plenum. Nozzle(s) are required in the lower plenum and also in each such riser. The riser portion is to be treated now as the hood duct opening and protected accordingly. (See Figure 3-34).

Example 2 — Riser more than 6 in. (152 mm) in Length

Figure 3-34. Special Plenum Arrangements With 6 in. (152 mm) Risers

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3-6.1.2 SPECIAL CONFIGURATIONS

3-6.1.2.1 Protection of Electrostatic Precipitators

Electrostatic precipitators (ESP) are designed to remove smoke and other airb from the airstream flowing through exhaust ductwork. ESPs are used in restaur systems as a means of pollution control. They are not intended to replace grease fi means of grease extraction. ESPs obstruct exhaust airflow and therefore requir addition to a nozzle(s) protecting the ductwork.

Exhaust ductwork using ESPs require ADP nozzle(s). The ADP nozzle(s) must be located centrally in the ductwork and should be aimed at the middle of the ESP. Distribution piping to the ADP nozzle located above the ESP and the ADP nozzle aimed at the precipitator must not interfere with the function of the ESP unit. See Figure 3-35.

Figure 3-35. Nozzle Placement with Electrostatic Precipitator

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3-6.1.2.2 Transitional Duct

The proposed protection for transitional duct applications should be appro
Having Jurisdiction) prior to starting this system installation. Badger reco
ducts be protected as follows.

Measure the dimensions at six inches into the transition piece. Determi
required by the perimeter measured at the six-inch location. Place the tip of
into the transition piece. See Figure 3-36.

Figure 3-36. Transitional Duct

3-7 CYLINDER FLOWS

After finding how many nozzles of each type are required for a system, the sum c
numbers is used to determine the number and size of the cylinders required, in a
cylinder flow number limits given below.

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Table 3-30. Cylinder Flow Number Limits

Maximum Flow Numbers of Cylinders	
Cylinder	**Flow Number**
RG-1.25G	4 — Single Cylinder Systems Only (cannot manifold)
RG-2.5G	8 — Single Cylinder Systems Only (cannot manifold)
RG-4GS/RG4GM	Can manifold up to 4 cylinders[1]
1 Cylinder	12
2 Cylinders	24
3 Cylinders	36
4 Cylinders	48
RG-6G	Can manifold up to 2 cylinders[1]
1 Cylinder	18
2 Cylinders	36

[1] Only like cylinders can be manifolded (i.e., four RG-4GS or RG-4GM; two RG-6G)

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3-8 PIPING REQUIREMENTS

Range Guard systems do not require balanced piping to achieve proper di
to all nozzles. Balanced piping is not necessary because a liquid has no di
or changing directions. Range Guard nozzles come equipped with permane
This means that the liquid will be delivered in the exact quantities necessar
appliance hazards as required.

All pipe shall be schedule 40 (standard weight) black steel. Pipe may be c
pipe shall not be used. All pipe and fittings must be made tight without pipe dope or thread sealant.

Pipe fittings shall be standard weight steel, cast iron, malleable iron or ductile iron. Galvanized fittings shall not be used. Branch line connection and individual nozzle connections may be made by using either the outlet or the run of a tee.

3-8.1 Stainless Steel Tubing and Fittings

Stainless steel tubing may be used on all Range Guard systems. Fittings may be stainless steel compression or stainless steel flare types. Bending of tubing using mandrels is permissible.

3-8.2 Pipe Sizing

Pipe sizes are determined by the total number of flow numbers running through a particular piece of pipe. This is the flow demand for that portion of the system.

Note: It is not permissible to drop pipe diameters below the required value. For example, using 1/2-inch pipe to flow 18 flow numbers is not permissible. However, increasing pipe diameter is acceptable (i.e., using 1-inch pipe to flow 18 flow numbers) providing the system complies with internal pipe volume limitations.

Table 3-31. Flow Number Range and Pipe Type

Flow Number Range	Minimum Pipe Size	.035 Wall Stainless Steel Tubing Size
1 — 2	1/4-inch	3/8-inch
1 — 8	3/8-inch	N/A
1 — 12	1/2-inch	5/8-inch
13 — 24	3/4-inch	7/8-inch
25 — 48	1-inch	1-inch

3-8.3 General Rules

- A maximum of 100 equivalent ft. (30.5 m) but not more than 40 linear ft. (12.2 m) of 1/4-in. pipe may be used from each branch line.
- The highest point of the system shall not exceed 12 ft. (3.7 m) above the cylinder outlet.
- The vertical rise of a branch line above the supply line shall not exceed a maximum of 4 ft. (1.2 m).
- Maximum discharge pipe volume limitations shall not be exceeded.
- Maximum equivalent length limitations shall not be exceeded.
- Maximum flow points for a given pipe shall not be exceeded.
- There are to be no low points or “traps” present in discharge piping.

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3-8.4 Discharge Line Volume Limitations

There is a discharge line volume limitation in Range Guard systems. Discharg **total** volume of **all** pipe, tubing, and fittings used in single or multiple cylinder s

To measure discharge line volume, it is necessary to measure all pipe length fro fitting to the center of the next fitting and multiply by the volume-per-foot factor and Table 3-33.

Table 3-32. Piping Discharge Line Volume

Size	Piping Discharge Line Volume
1/4 in.	1.25 in.^{3} per linear foot — (67.2 cm^3 per linear meter)
3/8 in.	2.29 in.^{3} per linear foot — (123.1 cm^3 per linear meter)
1/2 in.	3.65 in.^{3} per linear foot— (196.2 cm^3 per linear meter)
3/4 in.	6.40 in.^{3} per linear foot — (344.1 cm^3 per linear meter)
1 in.	10.37 in.^{3} per linear foot — (557.5 cm^3 per linear meter)

Table 3-33. Tubing Discharge Line Volume

Size	Piping Discharge Line Volume
3/8 in.	0.88 in.^{3} per linear foot — (47.3 cm^3 per linear meter)
5/8 in.	2.90 in.^{3} per linear foot — (155.9 cm^3 per linear meter)
7/8 in.	6.11 in.^{3} per linear foot — (328.5 cm^3 per linear meter)
1 in.	8.15 in.^{3} per linear foot — (438.2 cm^3 per linear meter)

Table 3-34. Maximum Allowable Piping Volume

Cylinder Size	Total Discharge Pipe Volume Max. per Cylinder	Total Discharge Tubing Max. per Cylinder	Max. Allowable 3/8-inch Pipe Volume per System
RG-1.25G (4.7 L)	72 in.^{3} (1180 cm^3) [1]	51 in.^{3} (836 cm^3) [1]	72 in.^{3} (1180 cm^3)
RG-2.5G (9.5 L)	139 in.^{3} (2278 cm^3) [1]	99 in.^{3} (1622 cm^3) [1]	95 in.^{3} (1557 cm^3)
RG-4GS/4GM (15 L)	400 in.^{3} (6555 cm^3)	282 in.^{3} (4621 cm^3) [1]	95 in.^{3} (1557 cm^3)
RG-6G (22.7 L)	400 in.^{3} (6555 cm^3)	282 in.^{3} (4621 cm^3) [1]	95 in.^{3} (1557 cm^3)

[1] Cannot Manifold

Note: The maximum allowable 3/8-inch pipe volume is not in addition to the total discharge line volume, but represents a portion of the total volume which may be dedicated to 3/8-inch pipe alone.

3-8.4.1 EQUIVALENT LENGTH LIMITATIONS

Equivalent feet is defined as the actual measured length of discharge line for each fitting in the line as obtained from the data given in Table 3-35 an

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Table 3-35. Pipe Fitting Equivalent Length

Pipe Fittings	Equivalent Length				
	1/4 in. (6.3 mm)	3/8 in. (9.5 mm)	1/2 in. (13 mm)	3/4 in. (19 mm)	1 in. (25.4 mm)
90° Elbow	0.9 ft. (.27 m)	1.3 ft. (.40 m)	1.5 ft. (.46 m)	2.1 ft. (.64 m)	2.7 ft. (.82 m)
45° Elbow	0.4 ft. (.12 m)	0.6 ft. (.18 m)	0.8 ft. (.24 m)	1.0 ft. (.30 m)	1.3 ft. (.40 m)
Tee (Outlet)	2.0 ft. (.61 m)	2.7 ft. (.82 m)	3.5 ft. (1.07 m)	4.5 ft. (1.37 m)	5.8 ft. (1.77 m)
Tee (Run)	0.5 ft. (.15 m)	0.8 ft. (.24 m)	1.1 ft. (.34 m)	1.4 ft. (.43 m)	1.7 ft. (.52 m)
Red. (1/2 in. to 1/4 in.) (13 mm to 6.3 mm)	0.3 ft. (.09 m)	—	—	—	—
Red. (1/2 in. to 3/8 in.) (13 mm to 9.5 mm)	—	0.3 ft. (.09 m)	—	—	—
Red. (3/4 in. to 1/2 in.) (19 mm to 13 mm)	—	—	0.4 ft. (.12 m)	—	—
Red. (1 in. to 3/4 in.) (25.4 mm to 19 mm)	—	—	—	0.5 ft. (.15 m)	—

Equivalent feet is measured from the cylinder (the farthest cylinder in a manifold) to the most remote nozzle. Equivalent feet is also measured between the two most remote nozzles. Equivalent feet is measured only along that branch with the most equivalent feet. Table 3-37 lists the maximum equivalent lengths for each cylinder size.

Table 3-36. Tube Fitting Equivalent Length

Tube Fittings	Equivalent Length			
	3/8 in. (9.5 mm)	5/8 in. (16 mm)	7/8 in. (22 mm)	1 in. (25.4 mm)
90° Elbow	1.5 ft. (.46 m)	2.5 ft. (.76 m)	4.0 ft. (1.22 m)	4.5 ft. (1.37 m)
90° Bend	0.5 ft. (.15 m)	1.0 ft. (.30 m)	1.0 ft. (.30 m)	1.0 ft. (.30 m)
45° Elbow	0.8 ft. (.24 m)	1.3 ft. (.40 m)	2.0 ft. (.61 m)	2.3 ft. (.70 m)
45° Bend	0.5 ft. (.15 m)	0.5 ft. (.15 m)	0.5 ft. (.15 m)	0.5 ft. (.15 m)
Tee (Outlet)	1.5 ft. (.46 m)	2.5 ft. (.76 m)	4.0 ft. (1.2 m)	4.5 ft. (1.37 m)
Tee (Run)	0.5 ft. (.15 m)	0.5 ft. (.15 m)	1.0 ft. (.30 m)	1.0 ft. (.30 m)

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Figure 3-37. 1/2 in. (13 mm) Piping with 90° Elbow

Equivalent Feet (from Table 3-35)

90° 1/2 in. (13 mm) Elbow:	1.5 eq. ft.
90° 1/2 in. (13 mm) Elbow:	1.5 eq. ft.
	1.0 ft. of 1/2 in. (13 mm) Pipe
	4.0 eq. ft. TOTAL

A tee can be considered one of two ways, depending on orientation. Figure 3-47 shows the different orientations that can occur. The equivalent feet for a reducing tee is determined by the larger size of the tee. Refer to Table 3-9 or 3-10 for equivalent feet.

EXAMPLE

Figure 3-38. Tees

Table 3-37. Remote Nozzles

Cylinder Size	Equivalent Feet from Cylinder to Most Remote Nozzle	Equivalent Feet Between Most Remote Nozzles
RG-1.25G	39 ft. (11.9 m)	33 ft. (10.1 m)
RG-2.5G	63.4 ft. (14.3 m)	43.7 ft. (13.3 m)
RG-4GS/4GM	132 ft. (40.2 m)[2]	95 ft. (29 m)[2]
RG-6G	75 ft. (22.9 m)[2]	80 ft. (24.4 m)[2]

[2] The maximums listed in Table 3-37 apply to manifold systems as well as single cylinder systems.

3-8.4.2 MINIMUM PIPE LENGTH

The minimum pipe length, to prevent splash, required between cylin appliance nozzle used to protect a liquid hazard, such as a deep fat fryer, i pipe sizes larger than 1/2-inch (1.3 cm) use formulas 1 and 2, to find the eq (1.3 cm) pipe.

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Table 3-38. Minimum Allowable Pipe

Pipe Size	Minimum Allowable Pipe
1/4-inch and 3/8-inch	8-1/2 (2.6 m) linear feet plus (1) 90° elbow (2.6 m)
1/2-inch	Two (2) 90° Elbows and 7 linear feet (2.1m)
3/4-inch and 1-inch	10 equivalent feet of 1/2-inch (13 mm) pipe (see formulas 1 & 2 and Figure 3-39)

Formula 1:

equivalent feet (meters) of 1-inch (25 mm) pipe x (0.079) = # of equivalent feet (meters) of 1/2-inch (13 mm) pipe

Formula 2:

equivalent feet (meters) of 3/4-inch (19 mm) pipe x (0.254) = # of equivalent feet (meters) of 1/2-inch (13 mm) pipe

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EQUIVALENT FEET CYLINDER TO CLOSEST NOZZLE

Figure 3-39. Pipe Size and Nozzle Distance

3/4-inch Pipe

(1) 1/2-inch to 3/4-inch reducer;	(1)(0.4) = 0.4 ft. of 3/4-inch Pipe
(2) 90° 3/4-inch elbow;	(2)(2.1) = 4.2 ft. of 3/4-inch Pipe
(1) 3/4-inch to 1/2-inch reducing Tee (run);	(1)(1.4) = 1.4 ft. of 3/4-inch Pipe
Linear Feet of 3/4-inch Pipe:	16.0
Equivalent Feet of 3/4-inch Pipe;	22 ft. of 3/4-inch Pipe

(a) (22.0) x (0.254) = 5.5 eq ft. of 1/2-inch Pipe. (from Formula 2)

1/2-inch Pipe

From (a)	5.5FT. of 1/2-inch Pipe
(1) 1/2-inch Tee (Outlet);	(1)(3.5) = 3.5 ft. of 1/2-inch Pipe
(1) 1/2-inch to 3/8-inch reducer;	(1)(0.3) = 0.3 ft. of 1/2-inch Pipe
Linear Feet of 1/2-inch Pipe:	5.5
Equivalent Feet of 3/4-inch Pipe;	14.8 ft. of 1/2-inch Pipe

Therefore, this example does meet the minimum pipe requirement.

3-8.4.3 SPECIAL 3/8-INCH PIPING ONLY SYSTEM

On RG-1.25G, RG-2.5G, RG-4GS, and RG-4GM single cylinder systems piping may be used for the entire piping network following the guide pneumatic release or pressure switch is used, it must be on the upper e vertical length of black pipe.

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Table 3-39. 3/8 in. Piping Only System

Limitations	RG-1.25G	RG-2.5G	RG-4GS/RG-4GM[2]
Maximum Discharge Line Volume	72 in.^{3} (1180 cm^3)	99 in.^{3} (1622 cm^3)	161 in.^{3} (2638 cm^3)
Maximum Equivalent Length of Discharge Line Between Cylinder and Most Remote Nozzle	39 ft. (11.9 m)	40 ft. (12.2 m)	59 ft. (18.0m)
Maximum Equivalent Length of Discharge Line Between Most Remote Nozzles	33 ft. (10 m)	42 ft. (12.8 m)	50 ft. (15.2 m)
Maximum Equivalent Length of 1/2-inch (13 mm) Discharge Pipe Between Cylinder and Hood	12 ft. (3.7 m)	12 ft. (3.7 m)	24 ft. (7.3 m)
Minimum Equivalent Length of Discharge Line Between Cylinder and an Appliance Nozzle Protecting a Liquid Hazard, such as Deep Fat Fryer	8-1/2 ft. (2.6 m) linear feet plus 90° elbow	8-1/2 ft. (2.6 m) linear feet plus 90° elbow	8-1/2 ft. (2.6 m) linear feet plus 90° elbow

[2] The limitations on this section (Paragraph 3-8.4.3) supersedes all other limitations when designing a system using 3/8-inch pipe originating from the 4-gallon cylinder outlet.

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3-8.4.4 DETECTOR

Detectors using Range Guard approved fusible link detectors are required over and in the ducts of kitchen cooking equipment per NFPA 17A and NFPA 96.

For protection of the duct, a detector must be centered either flush with the hooc the duct but not more than 12 feet (3.7 m) downstream from where the duct is coı When mounted in the duct, the detector should be oriented so that the bracket link from the hot air stream, and the fusible link is centered in the duct.

Maximum dimension per detector is 54 in. x 54 in. (1372 mm x 1372 mm).

Appliances having a surface area larger than 54 in. x 54 in. (1372 mm x 1372 mm) require additional detectors. When a cooking appliance is under the hood-duct opening, the appliance is protected by the detector mounted at the hood-duct opening or 12 in. (305 mm) maximum into the duct. An additional detector is not needed to protect that appliance.

A temperature survey must be performed at all locations where detectors will be installed. The survey must be conducted under maximum cooking or appliance cleaning conditions in order to determine the optimum exhaust air flow locations and to record the peak temperatures that are expected to occur.

Once the survey is completed:

- Select the lowest temperature rated detector that can be used.
- Make sure the maximum exposure temperature of the link exceeds the maximum temperature obtained from the survey.
- Make sure links are located in the exhaust air flow, not in dead air spaces. This will provide the fastest detector response.

Note: Care must be taken not to install links directly in the exhaust flow of appliance flue gas.

Figure 3-40. Positioning Detectors

3-9 UCH CONTROL SYSTEM DESIGN AND INSTALLATION PARAMETERS

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A System Valve Actuator (SVA) is used on every cylinder of the system. 1/4-i to connect from the Control System to each SVA. It has inlet and outlet p runs. The following tables define the UCH Control System design an limitations.

- Table 3-40 - Cable Limitations
- Table 3-41 - Actuation Length Limitations

Table 3-40. UCH Control System Cable Limitations

Cable Line	Max. Cable Length	Max. Corner Pulleys	Max. Detectors	Max. Tee Pulleys
Detection and Manual Release-to-Trip Line 1	200 ft. (61 m)	50	40	-
Detection and Manual Release-to-Trip Line 2	200 ft. (61 m)	50	40	-
Pull-to-Trip Remote Manual Release	100 ft. (31 m)	30	-	*
Mechanical Gas Valve Release	100 ft. (31 m)	30	-	*

* Tee pulleys count as two Corner Pulleys. Maximum is from Control System, through the pulley, to each device

Table 3-41. UCH Control System Actuation Length Limitations

Min. Operating Temp.	Number of Extinguishing System Cylinders	Max. Total Length of 1/4 in. O.D. x 0.031 in. Wall High Pressure Tubing	Max. Number of Pressure Switches (P/N 486536) in Actuation Line	Min. Tubing
0° F (-18° C)	1 — 12	106 ft. (32 m) — See Note 6	2	5 ft. (2 m)
0° F (-18° C)	13 — 20	91 ft. (28 m) — See Note 6	2	5 ft. (2 m)

The following are additional information and requirements regarding the actuation line tubing and flex hose.

1. Flex hose (P/N B120045), is required to connect the UCH Control System to the System Valve Actuator when the UCH Control System is cylinder mounted.
2. Copper tubing shall be 1/4-inch O.D. x 0.031-inch wall high pressure tubing.
3. When Control System is cylinder mounted and two or more cylinders are being actuated, a minimum of 5 ft. (1.5 m) of 1/4-inch O.D. x 0.031-inch wall tubing shall be used for actuation lines.
4. When Control System is wall mounted, a minimum of 5 ft. (2 m) of 1/4-inch O.D. x 0.031-inch wall tubing shall be used in the overall actuation line.
5. In every system, either single cylinder or multiple cylinder, a 1/8-inch NPT plug or vent check (P/N 877810) shall be used in the outlet port of the last System Valve Actuator(s) in the actuation line.
6. High pressure nitrogen tubing (P/N B120045-001 through B120045-003) may be used in place of copper tubing and not to exceed a maximum length of 30 feet (9 m).

3-10 A+ DESIGN AND INSTALLATION PARAMETERS

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The following tables define the A+ design and installation parameter limitations

- Table 3-42 - Detection Line Limitations
- Table 3-43 - Actuation Limitations

Table 3-42. A+ Detection Line Limitations

Item	Limitations
Detection Line	200 ft. (61 m)[1, 2]
Detectors	40
Corner Pulleys	40[2]

Table 3-43. A+ Actuation Limitations

Item	Limitations
Copper Tubing[3]	1/4-inch O.D. x .031 wall thickness x 23 ft. (7 m) Total[3] 3 feet (1 m) from A+ to 1st Cylinder (Min.)
SVAs	5

[1] Includes use of Remote Manual Control.

[2] If using Gas Valve, maximum 50 ft. (15 m) cable and 16 Corner Pulleys.

[3] A combined maximum of 23 ft. total (7 m) of 1/4-inch O.D. x .031 wall thickness copper tubing may be used to connect the A+ Control Box to the SVA(s) on the cylinder(s). The 23 ft. (7 m) total is comprised of 3 ft. (1 m) of tubing from the A+ to the 1st cylinder and 20 ft. (6 m) from 1st to the last cylinder.

CHAPTER 4
INSTALLATION

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4-1 INTRODUCTION

This chapter is intended for system installers. It outlines the steps needed to install the Range Guard Wet Chemical Fire Suppression System.

Before system installation begins, the entire hood, plenum, filters and exhaust duct should be thoroughly cleaned. A suppression system is not an alternative to good housekeeping. It does not eliminate the need for periodic cleaning of hoods, filters, and ducts.

4-2 GENERAL INSTALLATION REQUIREMENTS

All components shall be installed in accordance with the appropriate NFPA standard(s):

- Extinguishing system per NFPA 17A and NFPA 96
- Detection and alarm-control units (other than detectors) per NFPA 72
- Electrical connections per NFPA 70 and CSA
- This Design, Installation, Operation, and Maintenance Manual (DIOM) (P/N 9127100)
- Local Authority Having Jurisdiction (AHJ)

Only factory trained and authorized personnel are permitted to install or maintain Range Guard Wet Chemical fire suppression systems.

4-3 INSTALLATION OF SUPPRESSION

1. Install the mounting brackets to hold the Cylinder and Valve Assembly. For wall mounting, see Paragraph 4-3.1. For floor mounting, see Paragraph 4-3.2.
2. Mount the Cylinder and Valve Assembly on mounting brackets.
3. Install agent distribution piping.
4. Install nozzles.

4-3.1 Wall Mounting Bracket Installation, P/N 9197430, 9197263, 9197414, 9197415, 100013

The Wall Mounting Bracket is to be mounted vertically (plumb) with the Cylinder and Valve Assembly in the upright position. The mounting location shall be in a clean, dry and protected area where the ambient temperature is between 0°F (-18°C) and 120°F (49°C) and sufficiently away from the hazard(s) so as not to be exposed to process or fire temperatures in excess of 120°F (49°C). The bracket must be mounted in such a way that no part of the assembly stands in water or other liquid. The Cylinder and Valve Assembly should be mounted at least 4 inches (102 mm) above the floor.

1. Determine the Wall Mounting Bracket mounting locations and mark the mounting holes for bracket. When mounting to a wall stud, use the two in-line vertical holes in the bracket back. If mounting to a hood, use the two horizontal holes in the bracket back. Before drilling the mounting holes, be sure that the mounting surface will support the loads identified in Table 4-2.

2. Drill three holes for each Mounting Bracket and attach the bracket to the mc three (3) 3/8-inch diameter bolts or screws of suitable length and type. Us hardware is permitted.

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Figure 4-1. Wall Mounting Bracket

Table 4-1. Wall Mounting Bracket Specifications

Wall Mounting Bracket P/N	Model	Dimensions						
		A	B	C	D	E	F	G
9197430	RG-1.25G	3 in. (76 mm)	9-3/8 in. (238 mm)	1-3/8 in. (35 mm)	2 in. (51 mm)	3-1/4 in. (83 mm)	3-3/8 in. (86 mm)	—
9197263	RG-2.5G	4-1/2 in. (114 mm)	12 in. (305 mm)	2-1/2 in. (64 mm)	3-1/2 in. (89 mm)	3-3/4 in. (95 mm)	3 in. (76 mm)	5-1/4 in. (133 mm)
9197414	RG-4GM	4-1/2 in. (114 mm)	20-1/2 in. (521 mm)	2-1/2 in. (64 mm)	3-1/2 in. (89 mm)	13-1/4 in. (337 mm)	2 in. (51 mm)	11-1/4 in. (286 mm)
9197415	RG-4GS	4-1/2 in. (114 mm)	11-1/2 in. (290 mm)	2 in. (51 mm)	3-1/2 in. (89 mm)	3-3/4 in. (95 mm)	4-1/4 in. (108 mm)	4-1/4 in. (108 mm)
100013	RG-6G/RG-4GM	See Figure 4-2						

Table 4-2. Wall Mounting Bracket Wall Support Load

Wall Mounting Bracket P/N	Model	Wall Support Load
9197430	RG-1.25G	43 lb. (19.4 kg)
9197263	RG-2.5G	80 lb. (36 kg)
9197414	RG-4GM	132 lb. (60 kg)
9197415	RG-4GS	132 lb. (60 kg)
100013	RG-6G and RG-4G	225 lb. (102 kg)

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Figure 4-2. RG-6G Wall Mounting Bracket

Table 4-3. RG-6G Wall Mounting Bracket Specifications

Wall Mounting Bracket P/N	Model	Dimensions						Wall Support Load
		A	B	C	D	E	F	
100013	RG-6G and RG-4GM	21-1/8 in. (537 mm)	11 in. (279 mm)	10-1/8 in. (258 mm)	5-5/8 in. (143 mm)	12-1/2 in. (318 mm)	4 in. (102 mm)	225 lb. (102 kg)

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4-3.2 Floor Mount Bracket Kit Installation, P/N 100010

A Floor Mount Bracket Kit is used for mounting the RG-6G and RG-4GM cylinc
Floor Mount Bracket Kit requires Wall Mounting Bracket P/N 100013 See Figure

1. Attach the Floor Mount Bracket Kit to the Wall Mounting Bracket using four 3/8-inch diameter bolts of suitable length.
2. Determine the Floor Mount Bracket mounting locations and mark the mou bracket.
3. Drill two holes for each Floor Mount Bracket and attach the bracket to the floor surface with four (4) 3/8-inch diameter bolts or screws of suitable length and type. See Table 4-3 for dimensions and load bearing information.

Note: Use of other approved hardware is permitted.

Figure 4-3. Floor Mount Bracket Kit Attached to Wall Mounting Bracket

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4-3.3 Cylinder and Valve Assembly Installation

Upon removal of each Cylinder and Valve Assembly from its shipping ca
following:

1. Ensure that the Anti-Recoil Plate and the Valve Protection Plate are se

Figure 4-4. Anti-Recoil and Valve Protection Plates

WARNING

The Anti-Recoil Plate must remain installed on the valve outlet at all times except when the cylinder is mounted to a properly secured mounting bracket. The Protection Cap must remain on the valve until the System Valve Actuator (SVA) is installed. Refer to the Safety Summary for more information on pressurized cylinders.

2. Check that the cylinder pressure is within the acceptable range shown on the pressure gauge. If not, replace with a properly charged cylinder.
3. Inspect the Cylinder and Valve Assembly for any signs of damage such as dents, nicks or scratches. Refer to Compressed Gas Association (CGA) pamphlet C-6 for cylinder inspection procedures. Refer to http://www.cganet.com for more details.
4. Place each Cylinder and Valve Assembly on its bracket shelf, tighten the cylinder strap and check the mounting for proper fit. Make any necessary final adjustments.

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4-3.4 Installing the Discharge Adapter Kit, P/N 83-844908-000

1. Remove the cylinder Anti-Recoil Plate. **Do not discard**.
2. Lubricate the O-ring with a light coating of Parker Super-O-Lube. Do not gre on valve check. Place the O-ring in the groove near the inlet end of the Disch
3. Insert the Discharge Adapter through the hole in the flange plate (see Figure
4. Install the Discharge Adapter into the valve outlet.
5. Install the two 5/16-18 x 1-inch bolts through the cylinder valve and flange adapter and tighten.

Each Cylinder and Valve Assembly must be installed in an upright position using the Mounting Bracket specified in Table 4-1 and Table 4-3. Each Cylinder and Valve Assembly will also utilize a Discharge Adapter Kit (P/N 83-844908-000).

Figure 4-5. Installing the Discharge Adapter Kit, P/N 83-844908-000

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4-3.5 Installation of Pipe/Tubing and Fittings

4-3.5.1 AGENT DISTRIBUTION PIPING

Note: If a Pneumatic Release (P/N 9189412) is to be used, refer to Paragr
Switch (P/N 9197023) is to be used, refer to Paragraph 4-3.5.2.

Install the agent distribution piping as defined in Chapter 3, or enclosures

Note: Use of bushings is permitted.

CAUTION

Do not exceed the maximum pipe lengths, equivalent pipe lengths or pipe fitting parameters as defined in Chapter 3 or the system may not operate as intended.

Piping may be Schedule 40, black steel, or stainless steel. All fittings shall be a minimum of 150 lb. class. Examples of acceptable fitting materials include malleable iron, ductile iron or stainless steel compression or stainless steel flare types. Couplings and unions may be used where necessary, and reducing bushings or reducing tees can be used for changes in pipe diameter. Refer to NFPA 17A, latest edition.

CAUTION

Galvanized pipe and fittings are not permitted.

Pipe hangers or pipe clamps shall be used for support as required. Refer to local plumbing codes for piping requirements.

WARNING

Do not use water or oxygen to blow out piping. Moisture will cause blockage. The use of oxygen is very dangerous as the possible presence of even a minute quantity of oil may cause an explosion, thereby causing death, serious personal injury and/or property damage.

Before installing the agent distribution piping, ensure that the inside of the pipe is clean and free of obstructions. Piping shall be reamed and cleaned before assembly. After the piping is installed, it must be blown clean with dry air or nitrogen. Pipe thread compound or tape shall not be used. Refer to NFPA 17A, latest edition.

Avoid low points or "traps" in the pipe work that would allow liquid to accumulate.

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When using stainless steel tubing, the following minimum bend radii must be m

Table 4-4. Tubing Radius

.035 Wall Stainless Steel Tubing	Minimum Bend Radius,
3/8 in. (9.5 mm)	15/16 in. (24 mm)
1/2 in. (13 mm)	1-1/4 in. (32 mm)
5/8 in. (16 mm)	1-1/2 in. (38 mm)
7/8 in. (22 mm)	2 in. (51 mm)
1 in. (25 mm)	3 in. (76 mm)

Figure 4-6. Stainless Steel Tubing

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4-3.5.2 PRESSURE SWITCHES (IF APPLICABLE), P/N 9197023

The Pressure Switch is screwed on the upper end of a 12-inch (305 mm) le (riser). The vertical riser is fastened to a tee which may be located wl discharge pipe. The piping used to plumb the pressure switch must volumetric calculation for the overall discharge piping and individual bran

Note: Risers used are part of total piping volume and must be considered when doing piping calculations.

The required mounting position is upright. The Pressure Switch has 1/2-inch NPT pressure inlets to connect to the piping. The electrical connections are either 1/2-inch conduit knockouts or 1-inch NPT fittings.

Note: Two Pressure Operated Switches can be installed on pressure actuation lines.

Figure 4-7. Installing Pressure Switch, P/N 9197023

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4-3.5.3 1/2-inch VENT PLUG, P/N 9196984

The vent plug has a 1/2-inch (13 mm) NPT and can be installed in the outlet or the discharge pipe. In all systems requiring multiple cylinder systems, only one ve The vent plug must always point up or horizontally, never down, to assure that during discharge.

Note: It is necessary to use a bushing with the vent plug when installing the ven than 1/2-inch (13 mm).

Figure 4-8. 1/2-inch Vent Plug, P/N 9196984

4-3.6 Installing Nozzles

CAUTION **Do not use teflon tape or pipe compound when installing nozzles. Refer to NFPA 17A.**

CAUTION **The nozzles are made of brass. Use a 13/16 open-end or adjustable wrench and tighten until snug. Do not overtighten.**

Note: Ensure nozzle caps are installed on the nozzles. Do not overtighten or foil seals will be damaged.

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4-4 INSTALLATION OF CONTROLS

4-4.1 UCH Control System Installation

Remove the UCH Control System from its shipping carton.

CAUTION **Use care when removing the knockouts as you can damage tl enclosure.**

CAUTION **Ensure that the knockout pieces of the mounting holes do not remain inside the UCH Control System (P/N B120099) enclosure. Failure to remove these could cause malfunction of the mechanism.**

Identify the knockouts that will be used for cable connections to the UCH Control System enclosure. It is easiest if these knockouts are removed before mounting the UCH Control System enclosure. Refer to Figure 4-9 for knockout designations.

Note: If using more than the three EMT connectors supplied with the UCH Control System, you must use EMT Connector and O-Ring Kit, P/N 120058.

Figure 4-9. Pipe Connection Knockout Designations

Note: If using Detection Line 2, select Detection Line 2 (Option 1) **OR** Detection Line 2 (Option 2). You **cannot** use both Detection Line 2 knockouts.

Note: The knockouts are an integral part of the housing. Ensure that only required knockouts are broken out. Planning ahead and opening only the knockouts necessary for the system will help in keeping the box sealed from dirt, grease, water and other contaminants.

- If wall mounting, refer to Paragraph 4-4.1.1.
- If cylinder mounting, Paragraph 4-4.1.2.

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4-4.1.1 INSTALLING THE UCH CONTROL SYSTEM (WALL MOUNT)

1. With the UCH Control System cover removed, lay the box on its back. Locat holes in the housing. Position the box so that the mounting holes are not flat and break out the knockouts. See Figure 4-10 for location of mounting hole

Figure 4-10. Location of Mounting Holes (Housing)

2. Using 1/4-20 x 3-inch long toggle bolts or equivalent hangers, mount the box to the wall making sure it is level. Attach the conduit fittings and other fittings to the box. Run cables and wiring as normal, within the parameters of the UCH Control System. See Paragraph 4-7.1.4.1 for cable parameters.
3. Locate the System Valve Actuators (SVA).
4. Ensure the piston of the SVA is in the 'Set' position. See Figure 4-11.

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Figure 4-11. SVA in 'Set' Position

5. Remove the Valve Protection Plate from the top of the cylinder valve.
6. Install the SVAs onto each cylinder valve (the piston facing cylinder valve). Do not tighten them as they will be removed at a later time.
7. Install 1/8-inch NPT pipe plug (P/N 877810) or optional vent check on last SVA (end of line).
8. Install 1/8 NPT (M) x 1/4 copper tubing adapters. Compression type adapters are permissible.
9. Measure and install the 1/4 O.D. x 0.031 wall thickness copper tubing. A 2-1/2 inch (64 mm) loop between each cylinder and on the inlet tubing is recommended, but not required. See Figure 4-12. Ensure that each connection is secure.

Figure 4-12. Example of Copper Tubing Loop Method

10. Remove the SVAs from the cylinder valves and re-install the Valve Protection Plates.

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4-4.1.2 INSTALLING UCH CONTROL SYSTEM (CYLINDER MOUNT)

1. Locate the System Valve Actuators (SVA).
2. Ensure the piston of the SVA is in the 'Set' position.

Figure 4-13. SVA in 'Set' Position

3. Remove the Valve Protection Plate from the top of the cylinder valve.
4. Install the SVAs onto each cylinder valve (the piston facing cylinder valve). The ports on the SVA should be positioned towards the discharge adapter. Do not tighten the SVA(s) as it will be removed at a later time.

Figure 4-14. SVA Installation (Cylinder Mount)

5. Install UCH Control System onto the SVA.

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6. Install SVA bolts through the bottom of the UCH Control System into

Figure 4-15. Mounting the UCH Control System to the SVA

7. For multiple cylinder installations, install 1/8 NPT (M) x 1/4 copper tubing adapters. Compression type adapters are permissible.
8. For multiple cylinder installations, measure and install the 1/4 O.D. x 0.031 wall thickness copper tubing. A 2-1/2-inch (64 mm) loop between each cylinder and on the inlet tubing is recommended, but not required. See Figure 4-16. Ensure that each connection is secure.

Note: Minimum 5 ft. (1.2 m) copper tubing (total).

9. Install the 1/8 NPT (M) x 3/8-24 JIC flare adapter (included with the High Pressure Nitrogen Tubing, P/N B120045) onto the outlet port of the UCH Control System.

Note: Do not use teflon tape.

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Figure 4-16. Example of Copper Tubing Loop Method

10. Secure the 3/16-inch braided High Pressure Nitrogen Tubing (P/N B120045) onto the SVA. Ensure the connection is tight.

CAUTION **The High Pressure Nitrogen Tubing is *required* between the UCH Control System and the primary SVA on all cylinder mounted installations.**

Note: Do not attach the swivel end of the hose onto the outlet of the UCH Control System.

Figure 4-17. Installing High Pressure Nitrogen Tubing

11. Remove the SVAs from the cylinder valves and re-install the valve protection plates.

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Figure 4-18. Dimensions of Cylinder, Valve, SVA, and UCH Control System

Table 4-5. Cylinder and Valve Assembly Specifications

Model	Dimensions				
	A Center of Discharge Port	**B Top of Cylinder Valve**	**C Center of SVA Port**	**D Top of SVA**	**E Overall Height**
RG-1.25G	13-3/4 in. (349 mm)	15-1/4 in. (387 mm)	16-1/2 in. (419 mm)	17 in. (432 mm)	25-1/8 in. (638 mm)
RG-2.5G	19-9/16 in. (497 mm)	21 in. (534 mm)	22-5/16 in. (567 mm)	22-3/4 in. (578 mm)	30-15/16 in. (786 mm)
RG-4GS	17-1/2 in. (445 mm)	19 in. (483 mm)	20-1/4 in. (514 mm)	20-3/4 in. (527 mm)	28-7/8 in. (733 mm)
RG-4GM	22-15/16 in. (583 mm)	24-7/16 in. (621 mm)	25-11/16 in. (652 mm)	26-3/16 in. (665 mm)	34-5/16 in. (872 mm)
RG-6G	33-11/16 in. (856 mm)	35-3/16 in. (894 mm)	36-7/16 in. (929 mm)	36-15/16 in. (938 mm)	45-1/16 in. (1145 mm)

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4-4.1.3 ACTUATION

Figure 4-19 illustrates the steps to follow when deciding what type of actuation t

Note: Refer to the DIOM manual for the specified fire control panel.

Figure 4-19. Decision Flow Chart for Actuation

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4-4.1.4 MECHANICAL DETECTION INSTALLATION

4-4.1.4.1 Installing Detection Components

1. Drill holes as necessary for installation of the Quick Seal Adap Compression Seal Adapters (P/N 2650460X).
2. Mount the detector brackets as required.

WARNING **Be sure mounting penetrations are liquid and grease tight.**

3. Install conduit from the UCH Control System detector conduit knockout(s) (top or right side of the UCH Control System) to the detector brackets using Corner Pulleys (P/N B844648) at all changes in direction.
4. Remove screws and covers from the Corner Pulleys and set aside for reuse later.

Note: No bends or offsets are permitted in conduit lines. Be sure the system is adequately supported.

Figure 4-20. Unacceptable Cable Configuration

5. Run the 1/16-inch Control Cable from the various system devices, through 1/2-inch EMT conduit, to the UCH Control System.
6. Install detectors of proper rating as described in Paragraph 2-2.3. To install detectors, use the following steps. Always start detector installation at the last detector (see Figures 4-21 and 4-22).

Note: Detector Housing Kit, P/N 804548 **cannot** be used on the A+ Control Box.

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7. To install detectors, create a cable loop using a Crimp Sleeve (P/N 214951), a
253538).

Figure 4-21. Detector Housing Kit Installation, P/N 804548

WARNING **Use of a crimp tool besides P/N 253538 can cause malfunction and/or unwanted discharge of the system.**

Note: In order to ensure the crimp sleeve is secure, the cable must always be looped so that there are two lengths of cable inside the Crimp Sleeve before crimping. Cable must not be spliced anywhere along its length.

8. Place the Crimp Tool on the end of the sleeve. Ensure the flat of the sleeve rests in the saddle of the Crimp Tool jaw. Secure the sleeve in the tool carefully to ensure the sleeve does not shift in the saddle before pressing.
9. Squeeze the handles of the Crimp Tool until the tool releases itself. The tooth of the jaw is pressing on the wall of the sleeve without cracking the malleable copper. The first crimp is complete.
10. Remove the crimp from the tool.
11. Put the Crimp Tool onto the other end of the sleeve. The sleeve shall be 180° turned in the tool from the first crimp.

Note: This is pressing the loop end of the sleeve (opposite that of the first press).

12. Squeeze the handles of the Crimp Tool until the tool releases itself. The tooth of the jaw is pressing on the wall of the sleeve without cracking the malleable copper. The second crimp is complete.
13. Remove the crimp from the tool.

CAUTION **To ensure proper system operation, each detector must be installed so that at least 1-1/2 inches of cable movement toward the UCH Control System is maintained.**

14. Attach an “S” hook (P/N 9189413) to the end of the last detector mour
15. Attach proper detector onto the “S” hook.
16. Attach 1/16-inch cable to the hook at the other end of the detector, foı place by a Crimp Sleeve.

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Figure 4-22. Universal Link Housing Installation

WARNING **Be sure mounting penetrations are liquid and grease tight.**

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4-4.1.4.2 Cabling Mechanical Detection — Both Lines

Line 1 (knockout 3), turn ratchet wheel (counterclockwise) of detection beam unt hole is vertical (see Figure 4-23).

Line 2 (knockout 4/6), turn ratchet wheel of detection beam until the cable throug

Note: When cabling detection line 2, use either Knockout 4 or Knockout 6.

1. Feed the end of the cable through the hole into the center of the ratchet whe toward you. Leave approximately 6 inches (152 mm) of cable.
2. Slip a Crimp Sleeve (P/N 214951) over the end of the cable. Making a loop, slip the end back through the Crimp Sleeve.
3. Using Crimping Tool (P/N 253538) crimp the sleeve to the cable.

DETECTION BEAMS IN RELEASED POSITION

DETECTION BEAMS IN SET POSITION

Figure 4-23. Cabling Mechanical Detection

4. Cut the loop off of the crimped cable assembly. Cut any loose ends off as close to the Crimp Sleeve as possible.

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5. Pull the ends of the crimped cable back through until the end of the cal chamber of the ratchet wheel.
6. By hand, turn the wheel until the cable wraps around the spool of the now ready to be set.

   If the line is fully cabled, the detection line may be set.

Note: If using Detection Line 2, Knockout 4, the cable must go around the pulley wheel before going into the cable port of the ratchet wheel. When tightening the cable around the spool, it is important that the cable be seated in the bottom of the groove on the pulley wheel.

The cable may tend to wrap itself around other components in the UCH Control System. Use caution in tightening the cable to ensure the proper path or a cable jam could occur resulting in the malfunction of the system.

CAUTION

Use care when tightening the cable. Tighten cable until the detection arm makes contact with the beam stop. Do not overtighten.

Figure 4-24. Close Up View of Detection Lines 1 and 2 Beam Stops

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4-4.1.4.3 Cabling Detection Line 1 Only — Includes Lockout of Detection Line 2

Figure 4-25. UCH with Detection Line 2 Locked Out

Table 4-6. Cabling Detection Line 1 Only

Item	Description
1	Lockout screw pad (shown with one red lockout screw removed)
2	Actuation Latch
3	Spring and beam for Detection Line 2 (locked out)
3A	Spring Post for Detection Line 2 (spring removed)
4	Spring and beam for Detection Line 1 (set with cable)
4A	Spring Post for Detection Line 1
5	Beam Stop for Detection Line 1
6	Beam Stop for Detection Line 2
7	Lockout pad for Detection Line 1 (not used, line set)
8	Lockout pad for Detection Line 2 (red lockout screw inserted)

1. Ensure that nothing is armed or set in the UCH.
2. With the UCH completely disarmed, remove the spring from its respective post (item 3A, Detection Line 2). It is permissible to remove the spring from the detection beam.
3. Push the detection beam (item 3) against its respective beam stop (item 6).
4. Using a 9/64-inch allen key (hex) remove one of the red lockout screws from storage pad (item 1) and carefully thread into lockout pad (item 8).

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4-4.1.4.4 Cabling Detection Line 2 Only (Option 1)— Includes Lockout of Detec

Figure 4-26. UCH with Detection Line 1 Locked Out

Table 4-7. Cabling Detection Line 2 Only - Option 1

Item	Description
1	Lockout screw pad (shown with one red lockout screw removed)
2	Actuation Latch
3	Spring and beam for Detection Line 2 (set with cable)
3A	Spring Post for Detection Line 2
4	Spring and beam for Detection Line 1 (locked out)
4A	Spring Post for Detection Line 1 (spring removed)
5	Beam Stop for Detection Line 1
6	Beam Stop for Detection Line 2
7	Lockout pad for Detection Line 1 (red lockout screw inserted)
8	Lockout pad for Detection Line 2 (not used, line set)

1. Ensure that nothing is armed or set in the UCH.
2. With the UCH completely disarmed, remove the spring from its respective post (item 4A, Detection Line 1). It is permissible to remove the spring from the detection beam.
3. Push the detection beam (item 4) against its respective beam stop (item 5).
4. Using a 9/64-inch allen key (hex) remove one of the red lockout screws from storage pad (item 1) and carefully thread into lockout pad (item 7).

4-4.1.4.5 Cabling Detection Line 2 Only (Option 2)— Includes Lockout of Detection L

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Figure 4-27. UCH with Detection Line 1 Locked Out

Table 4-8. Cabling Detection Line 2 Only - Option 2

Item	Description
1	Lockout screw pad (shown with one red lockout screw removed)
2	Actuation Latch
3	Spring and beam for Detection Line 2 (set with cable)
3A	Spring Post for Detection Line 2
4	Spring and beam for Detection Line 1 (locked out)
4A	Spring Post for Detection Line 1 (spring removed)
5	Beam Stop for Detection Line 1
6	Beam Stop for Detection Line 2
7	Lockout pad for Detection Line 1 (red lockout screw inserted)
8	Lockout pad for Detection Line 2 (not used, line set)

1. Ensure that nothing is armed or set in the UCH.
2. With the UCH completely disarmed, remove the spring from its respective post (item 4A, Detection Line 1). It is permissible to remove the spring from the detection beam.
3. Push the detection beam (item 4) against its respective beam stop (item 5).
4. Using a 9/64-inch allen key (hex) remove one of the red lockout screws from storage pad (item 1) and carefully thread into lockout pad (item 7).

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4-4.1.5 ATTACHING MICROSWITCHES

4-4.1.5.1 High Mount Location for Microswitches

The High Mounted Microswitch mounts with the paddle(s) facing up into t 'Set' position, the Cam/Flag pushes down on the paddle(s) of the microswi released, the microswitch(es) release and change position (see Figure Figure 4-31 for wiring diagram).

The microswitches are best mounted when the system is in the 'Released' position. Two pairs of #4 screws are included with each microswitch kit: 5/8-inch long and 1-inch long x 3/32-inch Allen Key.

If mounting a single switch, use the 5/8-inch screws. If mounting two switches, use the 1-inch long screws.

After mounting the microswitch, turn the Cam/Flag to the 'Set' position to ensure the paddles move far enough down to change the phase of the microswitch. Use the included pigtail assembly to connect the microswitch to the circuit being monitored.

See Figure 4-33 to see the terminal type microswitch positions when the UCH Control System is in the Set and Released states.

See Figures Figure 4-30, Figure 4-31, Figure 4-32, and Figure 4-33 for wiring diagrams.

Note: It is recommended that the pigtails be threaded into the port before attempting to plug it onto the microswitch contacts. All splices and connections should be made in a separate approved electrical box connected by EMT or other approved conduit. See NFPA 70, NFPA 72, and CSA for proper wiring guidelines.

Figure 4-28. High Mount Microswitch, 'Released' and 'Set' Positions

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4-4.1.5.2 Deep Mount Location for Microswitches

The Deep Mounted Microswitch mounts with the paddle(s) facing down, away fro trigger. When in the 'Set' position, the trigger pin pushes up on the paddle(s) of the the Cam/Flag is released, the microswitch(es) release and changes position. S mounting information. See Figure 4-31 for wiring diagram.

The microswitches should be mounted when the system is in the 'Released' positi screws are included with each microswitch kit: 5/8-inch long and 1-inch long x 3

If mounting a single microswitch, use the 5/8-inch screws. If mounting two microswitches, use the 1-inch long screws.

After mounting the microswitch, turn the Cam/Flag to the 'Set' position to ensure the paddles move far enough up to change the position of the microswitch. Use the included pigtail assembly to connect the Microswitch to the circuit being monitored.

See Figure 4-33 to see the terminal type microswitch positions when the UCH Control System is in the Set and Released states.

See Figures 4-30, 4-31, 4-32, and Figure 4-33 for wiring diagrams. See Figure Figure 4-37 and Figure 4-38 for initiating and releasing wiring diagrams.

Note: It is recommended that the pigtails be threaded into the port before attempting to plug it onto the microswitch contacts. All splices and connections should be made in a separate electrical junction box connected by EMT or other approved conduit. See NFPA 70, NFPA 72, and CSA for proper wiring guidelines. Mounting the microswitch with the pigtails attached and inserted into the outlet is recommended.

CAUTION

When setting the Cam/Flag, make sure the trigger pin turns under the microswitch paddle(s) and pushes up to set the microswitch. If the trigger pin is “above” or between the paddle and the microswitch, the microswitch will not change position upon actuation of the UCH Control System which could result in system malfunction.

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Figure 4-29. Deep Mount Microswitch, 'Released' and 'Set' Positions

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4-4.1.6 WIRING MICROSWITCHES FOR UCH

These are used when it is necessary to open or close electrical circuits. The follc but not limited to:

- Electric appliance shutdown
- Make up air shutdown
- Electric gas valve shutdown
- Shuntbreaker/relay

Not for alarm initiation.

Figure 4-30. Microswitch Kit (in Released Position), P/Ns B120039, B230039-501

Table 4-9. Electrical Ratings for Microswitch Kit, P/Ns B120039, B120039-501

125/250 Vac	20.5 Amps
250 Vac	1-1/2 HP
125 Vac	1/2 HP

Figure 4-31. Position of Switch in Released Position

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Microswitch to be used for:

- Alarm initiation
- Solenoid release

Not to be used for:

- Electric appliance shutdown
- Make up air shutdown
- Electric gas valve shutdown
- Shuntbreaker/relay

Figure 4-32. Microswitch in Released Position, P/N B120047

Table 4-10. Electrical Ratings for Microswitch P/N B120047

250 Vac	15 Amps
250 Vac	1/2 HP
125 Vac	1/2 HP

Figure 4-33. Microswitch (Terminal Type) Position in Released Position

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4-4.1.7 MOUNTING THE SOLENOID, P/N B100034

The Solenoid can be used in conjunction with mechanical detection, or if mecha
Remote Manual Release is not needed. Red lockout screws are mounted in the c

The Solenoid includes an attached mounting bracket. Included in the hardwa
screws.

WARNING

The Solenoid operates on 24 Vdc only. Connection to any other voltage can result in non-operation, burning out of the coil or electrical injury to personnel.

Work on the Solenoid should never take place while the system is in the 'Set' and ready position. The Solenoid operates directly on the latch. Ensure that the System Nitrogen Cartridge is removed and the Cam/Flag assembly is released or locked out with the Keeper Pin (P/N 9197108).

1. Using a 3/32-inch Allen key, position the Solenoid behind the High-Pressure Nitrogen Tubing, aligning the mounting bracket with the mounting screw holes on the actuator mounting pad (see Figure 4-34).
2. Secure the Solenoid and bracket assembly to the UCH Control System enclosure with the enclosed 3/32-inch Allen screws.
3. Dress the wires from the Solenoid up above the internal nitrogen hose, along the bottom of the UCH and in front of the high mount microswitch mounting pad.
4. Using a cable tie, secure the Solenoid wires to the internal nitrogen hose.

Note: Wiring of the Solenoid must be done according to NFPA 72, National Fire Alarm Code, and NFPA 70, CSA and National Electrical Code. Wiring the Solenoid through a microswitch is required. The solenoid coil is 24 Vdc at 1.5 Amp and at 70°F (21°C). When actuating the UCH Control System with an optional solenoid, a UL compatible and listed fire control panel with a supervised power supply is required. (An Aegis panel for example.)

5. Wire the Solenoid to the microswitch:
   - Wire one lead from the Solenoid to terminal T1 of the microswitch.
   - Wire the second lead from the Solenoid through Knockout 1 or Knockout 2 through the conduit and into an approved control panel.
   - Finish the releasing loop by attaching a wire to T4 of the microswitch, through the conduit and into an approved control panel. See Figure 4-34, Figure 4-36 and Section 2-2.1.5.

Releasing the UCH Control System opens the contact and stops the releasing current.

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Figure 4-34. Solenoid Mounted and Wired in the UCH Control System

Note: Dress the wires from the Solenoid down along in front of the high mount microswitch mounting pad and out through Knockout 1 or Knockout 2.

Refer to Figure 4-37 and Figure 4-38 for initiation and releasing wiring diagrams.

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SWITCH POSITION WHEN UCH FLAG/CAM IS IN RELEASED POSITION

Figure 4-35. Alarm Wiring with Terminal Type Microswitch

SWITCH POSITION WHEN UCH FLAG/CAM IS IN SET POSITION

Figure 4-36. Release Wiring with Terminal Type Microswitch

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4-4.1.7.1 Locking Out Detection Lines 1 and 2

Figure 4-37. Locking Out Detection Lines 1 and 2 with Solenoid Mounted in UCH

Table 4-11. Locking Out Detection Lines 1 and 2

Item	Description
1	Lockout screw pad (shown with red lockout screws removed)
2	Actuation Latch
3	Spring and beam for Detection Line 2 (locked out)
3A	Spring Post for Detection Line 2 (spring removed)
4	Spring and beam for Detection Line 1 (locked out)
4A	Spring Post for Detection Line 1 (spring removed)
5	Beam Stop for Detection Line 1
6	Beam Stop for Detection Line 2
7	Lockout pad for Detection Line 1 (red lockout screw inserted)
8	Lockout pad for Detection Line 2 (red lockout screw inserted)

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1. Ensure that nothing is armed or set in the UCH.
2. With the UCH completely disarmed, remove the springs from their respec Detection Line 2, and item 4A, Detection Line 1). It is permissible to remove detection beam.
3. Push the detection beam (item 4) against its respective beam stop (item 5).
4. Push the detection beam (item 3) against its respective beam stop (item 6).
5. Using a 9/64-inch allen key (hex) remove red lockout screws from storag carefully thread into lockout pads (items 7 and 8).

CAUTION **Never lock out a detection line that is being used in a fire protection system.**

CAUTION **Refer to the tested and listed Control Panel DIOM manual for proper wiring instructions.**

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4-4.2 Installation of the A+ Control Box

Figure 4-38. A+ Control Box

First, determine if an optional microswitch (Single SPDT or Dual SPDT) kit is to be used as part of the A+ Control Box. If a microswitch is to be used, it must be installed in the A+ Control Box prior to mounting the control box to a wall. See the microswitch installation information in Paragraph 4-4.3.3 and Paragraph 4-4.3.4.

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4-4.3 Mounting the A+ Control Box

The A+ Control Box (Figure 4-39) is mounted with four 3/8-inch diameter bolts
The A+ Control Box may be installed in any position, allowing the cable to enter f
or either side.

The cover labels are applied to the outside of the cover after the A+ Control Box

Figure 4-39. Location of Mounting Holes

4-4.3.1 DETECTION INSTALLATION

Note: The maximum length of the detection line including a remote manual control, if used, is 200 feet (62 m).

Corner Pulleys (P/N B844648) are used for each change in direction. No bends or offsets are permitted. A maximum of 40 Corner Pulleys are allowed in the detection line. A maximum of 16 Corner Pulleys is allowed in the mechanical gas shut off valve cable line.

4-4.3.1.1 Installing Detection Components

1. Drill holes as necessary for installation of the Quick Seal Adapters (P/N 2649930X) or Compression Seal Adapters (P/N 2650460X).
2. Mount the detector brackets as required.

WARNING **Be sure mounting penetrations are liquid and grease tight.**

3. Install conduit from the A+ Control Box detector conduit knockout(s) to the detector brackets using Corner Pulleys (P/N B844648) at all changes in direction.

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4. Remove screws and covers from the Corner Pulleys and set aside for r

Note: No bends or offsets are permitted in conduit lines. Be sure t supported.

Figure 4-40. Unacceptable Cable Configuration

5. Run the 1/16-inch Control Cable from the various system devices, through 1/2-inch EMT conduit, to the A+ Control Box.
6. Install detectors of proper rating as described in Paragraph 3-2.4. To install detectors, follow the steps below. Always start detector installation at the last detector (see Figure 4-41).

Note: Detector Housing Kit, P/N 804548 **cannot** be used on the A+ Control Box.

7. To install detectors, create a cable loop using a Crimp Sleeve (P/N 214951), and Crimp Tool (P/N 253538).

WARNING **Use of a crimp tool besides P/N 253538 can cause malfunction and/or unwanted discharge of the system.**

Note: In order to ensure the crimp sleeve is secure, the cable must always be looped so that there are two lengths of cable inside the Crimp Sleeve before crimping. Cable must not be spliced anywhere along its length.

8. Place the Crimp Tool on the end of the sleeve. Ensure the flat of the sleeve rests in the saddle of the Crimp Tool jaw. Secure the sleeve in the tool carefully to ensure the sleeve does not shift in the saddle before pressing.
9. Squeeze the handles of the Crimp Tool until the tool releases itself. The tooth of the jaw is pressing on the wall of the sleeve without cracking the malleable copper. The first crimp is complete.

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10. Remove the crimp from the tool.
11. Put the Crimp Tool onto the other end of the sleeve. The sleeve shall be 180 from the first crimp.

Note: This is pressing the loop end of the sleeve (opposite that of the first press

12. Squeeze the handles of the Crimp Tool until the tool releases itself. The pressing on the wall of the sleeve without cracking the malleable copper. The second crimp is complete.
13. Remove the crimp from the tool.

CAUTION

To ensure proper system operation, each detector must be installed so that at least 3-inches of cable movement toward the A+ Control Box is maintained.

14. Attach an "S" hook (P/N 9189413) to the end of the last detector mounting bracket.
15. Attach proper detector onto the "S" hook.
16. Attach 1/16-inch cable to the hook at the other end of the detector, forming a cable loop held in place by a Crimp Sleeve.

Figure 4-41. Universal Link Housing Installation

WARNING

Be sure mounting penetrations are liquid and fire tight.

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17. Remove the white plastic plug from hole “A” on the side of the A+ Con
18. Connect 1/2-inch (13 mm) EMT to hole “A”.
19. Thread about 18 inches (452 mm) of cable through the hole “A” of the
20. Locate the slot in the back panel located behind the lever. Place the tip o
21. Pull down on the screwdriver causing the spring to stretch until the Ke body and lever are lined up.
22. Install the Keeper Pin (P/N 9197108). The A+ Control Box is now held Figure 4-42).

Figure 4-42. A+ Control Box in “SET” Position

23. Locate the Cable Tension Block Assembly. The adjusting screw and central roller must be in the uppermost position. Thread the detection cable through the cable tension block, passing over the two pins and under the central roller (see Figure 4-43).

Note: It is necessary for you to have already cut and crimped the detection line cable and installed the "S" hooks and fusible links prior to the step of removing the cable slack and making the final adjustments.

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Figure 4-43. Cable Tension Block Assembly, P/N 9197220

12. Thread the end of the detection cable through the hole in the lever and through the hole on the left side of the A+.
13. Fasten vise grips to the end of the detection cable. Pull on the detection cable and make sure to remove most of the cable slack.
14. Tighten the lever set screw onto the cable.
15. Tighten the adjustment screw on the Cable Tension Block Assembly until the tension on the cable is balanced and allows the Keeper Pin to easily slide out of the valve body. Leave the Keeper Pin in place until after the CO_2 cartridge is installed. This will prevent accidental discharge.

If the Keeper Pin does not slide out easily, not enough cable slack was removed when the cable was pulled through the valve body lever. Loosen the adjusting screw in the Cable Tension Block Assembly and then repeat steps above.

Note: It is recommended that you cut the detection cable close to the lever.

16. After completing the tensioning of the detection system, make sure that each detector has the required 3 inches (76 mm) minimum spacing, in the direction of cable travel, between the cable clamp or block and the end of the conduit fitting in the detector bracket.

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4-4.3.2 A+ TO SYSTEM VALVE ACTUATOR CONNECTION

Connect 1/4-inch (6 mm) O.D. copper tubing between the tubing elbow fitti valve and to each cylinder valve's System Valve Actuator. Make sure each (tubing fittings may be flared or compression type). Maximum length of a (6.1 m).

Note: Fittings supplied are compression type.

Figure 4-44. Installing 1/4-inch O.D. (6 mm) Copper Tubing

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4-4.3.3 INSTALLATION OF SINGLE SPDT SWITCH KIT (P/N 60-9197227-000) INT CONTROL BOX

These are used when it is necessary to open or close electrical circuits. The follc but not limited to:

- Electric appliance shutdown
- Make up air shutdown
- Electric gas valve shutdown
- Shuntbreaker/relay

1. Remove plug from hole “B” on the side of the A+ Control Box.
2. Connect 1/2-inch (13 mm) EMT to hole “B” on the side of the A+ Control Box (Figure 4-45).

Figure 4-45. Single SPDT Microswitch Installation

3. Mount the microswitch to the mounting bracket using (Figure 4-46):
   - two #4-40 X 5/8-inch (16 mm) long screws
   - two #4 lockwashers
   - two #4-40 nuts

Figure 4-46. Single SPDT Microswitch and Mounting Bracket

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4. Attach the mounting bracket to the A+ Control Box prior to wall mou
   - two #8-32 X 3/8-inch (10 mm) long screws,
   - two #8 lockwashers
   - two #8-32 hex nuts
5. Tighten the hex nuts
6. After tensioning the detection cable, rotate the microswitch tow microswitch is heard to click (Figure 4-47).
7. Continue moving the microswitch toward the lever until the paddle on the microswitch just touches the top corner of the microswitch body (Figure 4-47). The microswitch is now in the "set" position.
8. Tighten the microswitch screws and nuts.

Figure 4-47. Single SPDT Microswitch Adjustment

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9. Run the wires from the microswitch electrical connector out through hole " and into an external junction box. Refer to NFPA 70, and NFPA 72 latest edi

Refer to Figure 4-50 for alarm initiation wiring diagram.

Note: No wiring junctions are to be made in the A+ Control Box.

CAUTION **Failure to remove the Keeper Pin will result in an inoperative system.**

4-4.3.3.1 Wiring Microswitches For A+

These are used when it is necessary to open or close electrical circuits. The following are examples, but not limited to:

- Electric appliance shutdown
- Make up air shutdown
- Electric gas valve shutdown
- Shuntbreaker/relay

Note: Not for alarm initiation (See Figure 4-50 for alarm initiation wiring).

Figure 4-48. Microswitch Kit (in Discharged Position), P/Ns 60-9197227-000, 60-9197228-000

Table 4-12. Electrical Ratings for Microswitch Kit, P/Ns 60-9197227-000, 60-9197228-000

125/250/277 Vac	15 Amps
125/250/277 Vac	1/2 HP
125 Vdc	1/2 Amp
250 Vdc	1/4 Amp
120 Vac “L”	5 Amps

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Figure 4-49. Microswitch in Discharged Position

4-4.3.3.2 A+ Microswitch Wiring Schematic For Alarm Initiation

Figure 4-50. A+ Microswitch Wiring Schematic for Alarm Initiation

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4-4.3.4 INSTALLATION OF THE OPTIONAL DUAL SPDT SWITCH KIT (P/N 919722 CONTROL BOX

These are used when it is necessary to open or close electrical circuits. The follc but not limited to:

- Electric appliance shutdown
- Make up air shutdown
- Electric gas valve shutdown
- Shuntbreaker/relay

1. Remove plug from hole “B” on the side of the A+ Control Box.
2. Connect 1/2-inch (13 mm) EMT to hole “B” on the side of the A+ Control Box (Figure 4-51).

Figure 4-51. Dual SPDT Microswitch Installation

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3. Mount the microswitches to the mounting bracket. Ensure the cut lever under the paddle of the bent lever microswitch. Refer to Figure 4-52:

- two #4-40 X 1-inch (25 mm) long screws
- two #4 lockwashers
- two #4-40 nuts

Figure 4-52. Dual SPDT Microswitches and Mounting Bracket, P/N 9197228

4. Attach the mounting bracket to the A+ control box prior to wall mounting using:
   - two #8-32 X 3/8-inch (10 mm) long screws
   - two #8 lockwashers
   - two #8-32 hex nuts
5. Tighten the hex nuts.
6. After tensioning the detection cable, rotate the microswitches toward the lever until you hear the microswitches click (Figure 4-53).

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7. Continue moving the microswitches toward the lever until the paddle on the touches the top corner of the microswitch bodies (Figure 4-53). The micros the "set" position.
8. Tighten the microswitch screws and nuts.

Figure 4-53. Dual SPDT Microswitch Installation

9. Run the wires from the microswitch electrical connector out through hole "B" EMT connection and into an external junction box. Refer to NFPA 70 and NFPA 72, latest editions, and CSA.

Note: No wiring junctions are to be made in the A+ Control Box.

Refer to Section 4-4.3.3.1 for wiring microswitches.

CAUTION **Failure to remove the Keeper Pin will result in an inoperative system.**

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4-4.4 Optional Equipment Installation

4-4.4.1 INSTALLING REMOTE MANUAL RELEASE, P/N B875572 (UCH ONLY

The Remote Manual Release is equipped with a safety pin and seal wire w
permit installation of the control cable from the UCH Control System.

Note: The Remote Manual Release is optional if the UCH Control Systen
in a clearly visible, easily accessible, unobstructed location. If it
Release must be used for mechanical systems.

Install the Remote Manual Release as outlined in Steps 1 through 6 (see Figure 4-54).

1. Mount the Remote Manual Release at a means of egress, on a clear, unobstructed exit location between 42 — 48 inches (1067 — 1219 mm) above the floor. Refer to NFPA 17A and NFPA 96, latest editions.

   The cable can enter the handle from the side hole in the snap-out cover or from the rear of the handle. If the cable is to enter from the rear, perform alternate Steps 1-a and 1-b, otherwise, proceed to Step 2.

   a. Drill a hole in the wall opposite the position of the Remote Manual Release handle plug (when mounted).

   b. Attach a 1/2-inch EMT adapter to the hole in the wall.

2. Mount the back plate to the wall using mounting hardware of required length.
3. Remove the Corner Pulley covers to aid in installing the 1/16-inch steel cable through the system.
4. Feed the 1/16-inch steel cable through the Remote Manual Release through 1/2-inch conduit or EMT to the UCH Control System. Use Corner Pulleys (P/N B844648) for all changes in direction. Leave at least 12-inches of 1/16-inch steel cable coming out of the Remote Manual Release.

Note: The Remote Manual Release cable attaches to the latch of the UCH Control System. The Remote Manual Release uses Port 5 of the UCH Control System.

Figure 4-54. Remote Manual Release with Detection Lines 1 and 2 Locked Out

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5. There is a through hole in the end of the actuation latch. Carefully feed the cc the hole in the actuation latch.

Note: It is important that the control cable slips easily through the hole in the latch. The actuation latch must be able to operate without interference fro Later, the movement of the actuation latch assembly will be tested be setting of the UCH Control System. Approximately 1-1/4 inches (32 mm) o crimp end not included) should be left under the actuation latch, wh position.

6. Slip a Crimp Sleeve (P/N 214951) over the end of the control cable.
7. Making a loop, slip the end back through the Crimp Sleeve.
8. Use the Crimping Tool (P/N 253538) to fasten the Crimp Sleeve to the control cable.
9. Cut the loop off of the crimped cable assembly. Cut any loose ends off as close to the Crimp Sleeve as possible.
10. If a second Remote Manual Release is required, use the Tee Pulley assembly (P/N 843791).

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4-4.4.1.1 Attaching Remote Manual Release

Note: You can use two Remote Manual Releases with a Tee Pulley (P/N 8
Control System.

Figure 4-55. Exploded View of the Remote Manual Release

1. Attach a length of 1/16-inch steel cable to the Remote Manual Release handle, as follows (refer to Figure 4-56):
   a. Unscrew the cable nut from the Remote Manual Release pull handle.
   b. Thread the cable through the cable nut hex-head end at least 3 — 4 inches from the entry of the Remote Manual Release housing. Return the cable through the other hole of the cable nut hex-head.
   c. Screw the cable nut into the pull handle until tight. Insert the pull handle through the hole in the nameplate and housing.
   d. Cut excess slack where it emerges from the second hole in the hex-head end of the cable nut.
   e. Line up the holes in the pull handle and the housing and insert the safety pin to hold the plug in place. Loosely wrap the seal wire around the release handle to lock.

2. Attach the cover with nameplate to the mounting plate using the two screws
3. Reattach Corner Pulley covers.

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Figure 4-56. Installing the Remote Manual Release, P/N B875572

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4-4.4.1.2 Attaching Remote Manual Release Pull Station, P/N 60-120110-001 (Pull-to-Trip — Universal Control Head (UCH) ONLY)

Note: You can use two Remote Manual Releases with a Tee Pulley (F
Universal Control Head.

Figure 4-57. Remote Manual Release Pull Station, Pull-to-Trip (EMT/Conduit at Top)

Figure 4-58. Remote Manual Release Pull Station, Pull-to-Trip (EMT/Conduit at Bottom)

When installing the Remote Manual Release Pull Station, it may be surface mounted or recess mounted. The Remote Manual Release Pull Station is designed to mount in the same manner for the Pull-to-Trip mode and the Release-to-Trip mode.

Note: The supplied plastic sleeve is to be used on surface mount installations only.

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1. Mount the Remote Manual Release Pull Station at a means of egress, on a exit location between 42 — 48 inches (1067 — 1219 mm) above the floor. Ref NFPA 96, latest editions.

   The 1/16-inch (2 mm) diameter stainless steel detection line cable can enter t the top, bottom, or rear knockout in the housing. If the cable is to enter f housing, perform Step 1a., otherwise, proceed to Step 2.

   a. Drill a hole in the wall opposite the position of the Remote Manual (when mounted). The hole must be large enough for a 1/2-inch through.

2. Mount the housing to the wall or stud using mounting hardware of required length (Mounting hardware not supplied). If recess mount, attach the housing to a wall stud so that the front surface extends out from the wall stud 1/8-inch to 3/16-inch.
3. Feed the 1/16-inch steel cable through the Remote Manual Release Pull Station into the 1/2-inch conduit or EMT to the Universal Control Head (UCH). Leave at least 12-inches of cable coming out of the Remote Manual Release Pull Station.

Note: The Remote Manual Release cable attaches to the actuation latch of the UCH. The Remote Manual Release in Pull-to-Trip mode uses Port 5 of the UCH.

4. Install the roller to the housing using the #10-32 x 1/2-inch flat head screws provided. If the EMT/Conduit is at the top, refer to Figure 4-57. Route 1/16-inch (2 mm) diameter stainless steel detection line cable as shown. If the EMT/Conduit is at the bottom, refer to Figure 4-58. Route 1/16-inch (2 mm) diameter stainless steel detection line cable as shown.

WARNING **Verify that the 1/16-inch steel cable is behind the roller. Improper cable location will not allow for proper use!**

5. Install the sleeve over the housing (surface mount installations only).
6. Slide the detection line cable through the opening in the faceplate, and attach the faceplate to the housing, using the #10-32 pan head screws provided.
7. Thread the detection line cable through the hole closest to the Handle Assembly. Loop the cable around and through the other open hole. See Figure 4-59.
8. Tighten the setscrew on the end of the Handle Assembly. Pull the cable tight against the handle, and cut off any remaining loose cable close to the Handle Assembly as possible.

Figure 4-59. Remote Manual Release Pull Station Handle Assembly

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9. Insert the Handle Assembly into the faceplate, line up the holes on th hole on the Handle Assembly, and install the safety pin.

Note: Use the #8-32 screw on the handle assembly to rotate the handle and the faceplate collar to line up.

Figure 4-60. Securing the Remote Manual Release Pull Station

10. Tightly wrap the tamper seal around the faceplate collar, through the safety pin and behind the handle to lock.

Figure 4-61. Wrap Tamper Seal Around Pull Handle

Note: If a second Remote Manual Release is required, use the Tee Pulley assembly (P/N 843791).

4-4.4.1.3 Attaching Remote Manual Release Pull Station, P/N 60-120110-001 (Releas

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Figure 4-62. Exploded View of the Remote Manual Release Pull Station, Release-to-Trip

When installing the Remote Manual Release Pull Station, it may be surface mounted or recess mounted. The Remote Manual Release Pull Station is designed to mount in the same manner for the Pull-to-Trip mode and the Release-to-Trip mode.

Note: The supplied plastic sleeve is to be used on surface mount installations only.

1. Mount the Remote Manual Release Pull Station at a means of egress, on a clear, unobstructed exit location between 42 — 48 inches (1067 — 1219 mm) above the floor. Refer to NFPA 17A and NFPA 96, latest editions.

   The 1/16-inch (2 mm) diameter stainless steel detection line cable can enter the Pull Handle from the top of the housing.
2. Mount the housing to the wall or stud using mounting hardware of required length (mounting hardware not supplied). If recess mount, attach the housing to a wall stud so that the front surface extends out from the wall stud 1/8-inch to 3/16-inch.
3. Install a 3-Way Pulley (P/N 60-9197602-000) inline with the EMT connector.

WARNING **The rear knockout may NOT be used in this setup**.

Note: A 3-Way Pulley (P/N 60-9197602-000) cannot be used to operate dual gas valves. Only one (1) 3-Way Pulley can be used in a given detection system and must be counted as two (2) Corner Pulleys.

4. Feed the 1/16-inch steel detection line cable through the 1/2-inch condu
Manual Release Pull Station. There should be a loop of detection line
Housing and back through the 3-Way Pulley.

Note: The Remote Manual Release detection line cable attaches to the act
the lever of the A+ Control Box. The Remote Manual Release in F
Port 3 or 4 of the UCH, or Hole A of the A+ Control Box.

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CAUTION

No Corner Pulleys can be used between the 3-Way Pulley and the Remote Manual Release Pull Station.

5. Loosely install the Pin Block inside the housing using the #6-32 x 3/8-inch pan head screws provided.
6. Install the faceplate using the #10-32 x 1/2-inch screws provided.
7. Insert the Handle Pin so that it protrudes through the Pin Block.
8. Tighten the #6-32 x 3/8-inch pan head screws to secure the Pin Block.
9. Remove the faceplate and Handle Assembly. This step properly aligns the Pin Block with the faceplate.
10. Bring the detection line cable loop down inside the housing while placing it around the provided Pulley. Line up the Pulley with the hole in the Pin Block.
11. Place the Handle Pin through the Pin Block and then through the Pulley.

Note: Do not tighten detection line(s) at the UCH or A+ Control Box until Remote Manual Release Pull Station is completely assembled.

12. Install the sleeve over the housing (surface mount installations only).
13. Attach the faceplate using the #10-32 x 1/2-inch screws provided.
14. Place the Safety Pin through the Handle Pin and the faceplate collar.

Note: Use the #8-32 screw on the handle assembly to rotate the handle to get the hole in the pin and the collar to line up.

15. Attach the handle using the #8-32 flange button head screw.

Note: You can now tighten the detection line(s) at the UCH or A+ Control Box at this time.

If using as an End-of-Line device, use a clamp block instead of the Pulley.

16. Tightly wrap the tamper seal around the faceplate collar, through the safety handle to lock.

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Figure 4-63. Remote Manual Release Pull Station, Release-to-Trip (Side View)

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4-4.4.2 INSTALLATION OF SURFACE MOUNTED REMOTE MANUAL CONTRC CONTROL SYSTEM AND THE A+ CONTROL BOX, P/N 9197463

4-4.4.2.1 End-Of-Line Surface Mounted Remote Manual Control

Note: Refer to NFPA 17A and NFPA 96 about End-of-Line and In-Line sharing detection.

Note: Only use End-of-Line Remote Manual Release if no detectors are installed.

This control may be located at the end of the detection line, or anywhere in the detection line, by using a Tee Pulley. To install the end-of-line surface mounted manual control, proceed as follows:

1. Mount the Remote Manual Control at a means of egress, on a clear, unobstructed exit location between 42 — 48 inches (1067 — 1219 mm) above the floor. Refer to NFPA 17A and NFPA 96, latest editions.
2. Remove the cover plate. The control box is then mounted on the wall or other convenient support utilizing the mounting holes provided.
3. The cable is fastened to the cable block, and the pull pin is inserted through the front hole of the "U" bracket, anchoring the cable securely.
4. Before inserting the pin, it is necessary to slip it through the slot in the cover plate to permit replacement of the cover without interference with the retaining chain.
5. Before replacing the cover plate, a lead seal and wire (or equivalent) must be fastened through the ring of the pull pin and through the front hole of the "U" bracket (Figure 4-64).

Figure 4-64. End-of-Line Remote Manual Control, P/N 9197463

Note: The maximum total length of all 1/16-inch (2 mm) diameter stainless steel detection line cable for the A+ Control Box is 200 feet (61 m) and 40 Corner Pulleys maximum.

Note: A 3-Way Pulley (P/N 9197286) CANNOT be used to operate dual gas valves. Only one (1) 3-Way Pulley can be used in a given detection system and must be counted as two (2) Corner Pulleys.

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Figure 4-65. End-of-Line Remote Manual Control (Side View), P/N 9197463

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4-4.4.2.2 In-Line Surface Mounted Remote Manual Control

Note: Refer to NFPA 17A and NFPA 96 about End-of-Line and In-Line sharing detection.

Note: Only use End-of-Line Remote Manual Release if no detectors are in

To install the in-line surface mount remote control, use In-line Kit (P/N 91

1. Mount the Remote Manual Control at a means of egress, on a clear, unobstructed exit location between 42 — 48 inches (1067 — 1219 mm) above the floor. Refer to NFPA 17A and NFPA 96, latest editions.
2. Install a 3-Way pulley (P/N 9197602) in the horizontal conduit run.
3. Run the cable down through the vertical conduit to an end-of-line Surface Mounted Manual Control Box. Insert cable through conduit connector on one side of the roll pin (Figure 4-64).

CAUTION **No Corner Pulleys can be used between the 3-Way Pulley and the Remote Manual Release.**

4. Remove the cable clamp from the "U" bracket and replace it with the pulley from the In-line Kit (P/N 9197463).
5. Thread the cable around the bearing and back out the opposite side of the roll pin.

Note: A 3-Way Pulley (P/N 9197602) CANNOT be used to operate dual gas valves. Only one (1) 3-Way Pulley can be used in a given detection system and must be counted as two (2) Corner Pulleys.

6. Push the pull pin through the bearing and “U” bracket.

Figure 4-66. In-Line Remote Manual Control Kit (Front View), P/N 9197463

11. Before replacing the cover plate, a lead seal and wire (or equivalent) must l
the ring on the pull pin and through the small hole on the bracket.

Note: A 3-Way Pulley (P/N 9197602) CANNOT be used to operate dual gas val
Way Pulley can be used in a given detection system and must be counte
Pulleys.

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4-4.4.3 INSTALLATION OF RECESS MOUNTED IN-LINE REMOTE MANUAL C P/N 9197460

Note: Refer to NFPA 17A and NFPA 96 about In-Line Remote Manual Co

Note: Only use End-of-Line Remote Manual Release if no detectors are in

This control may be located at the end of the detection line, or anywhere in t a 3-way pulley.

1. Mount the Remote Manual Control at a means of egress, on a clear, unobstructed exit location between 42 — 48 inches (1067 — 1219 mm) above the floor. Refer to NFPA 17A and NFPA 96, latest editions. Ensure that the Remote Manual Control is attached to a wall stud so that the front surface extends out from the wall stud a distance equal to the thickness of the wall board.
2. Remove the cover plate and pull pin from the control.
3. Install a 3-Way pulley (P/N 9197602) in the horizontal conduit run.
4. Run the cable down through the vertical conduit to the Remote Manual Control Box. Insert cable through conduit connector on one side of the roll pin.

CAUTION **No Corner Pulleys can be used between the 3-way pulley and the Remote Manual Release.**

5. Thread the cable around the bearing and back out the opposite side of the roll pin.

Note: A 3-Way Pulley (P/N 9197602) CANNOT be used to operate dual gas valves. Only one (1) 3-Way Pulley can be used in a given detection system and must be counted as two (2) Corner Pulleys.

6. Push the pull pin through the bearing and “U” bracket.

Note: To prevent the cable from going up into the conduit, it is permissible to use an optional S-hook as shown in Figure 4-67 and Figure 4-68.

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Figure 4-67. Recess Mounted In-Line Remote Manual Control, P/N 9197461

7. Before replacing the cover plate, a lead seal and wire (or equivalent) must be fastened through the ring on the pull pin and through the small hole on the "U" bracket.

Note: The maximum total length of all 1/16-inch (2 mm) diameter stainless steel detection line cable for the A+ Control Box is 200 feet (61 m) and 40 Corner Pulleys maximum.

Note: A 3-Way Pulley (P/N 9197602) CANNOT be used to operate dual gas valves. Only one (1) 3-Way Pulley can be used in a given detection system and must be counted as two (2) Corner Pulleys.

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Figure 4-68. Recess Mounted In-Line Remote Manual Control (Side View), P/N 9197460

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4-4.4.4 INSTALLATION OF RECESS MOUNTED END-OF-LINE REMOTE MANUAL C 9197461

Note: Refer to NFPA 17A and NFPA 96 about End-of-Line Remote Manua detection.

Note: Only use End-of-Line Remote Manual Release if no detectors are installe

This control is located at the end of the detection line by using a 3-way pulley. T mount remote manual control proceed as follows:

1. Remove the cover plate and pull pin from the control.
2. Mount the Remote Manual Control at a means of egress, on a clear, unobstructed exit location between 42 — 48 inches (1067 — 1219 mm) above the floor. Refer to NFPA 17A and NFPA 96, latest editions. Ensure that the Remote Manual Control is attached to a wall stud so that the front surface extends out from the wall stud a distance equal to the thickness of the wall board.
3. Run the cable down through the vertical conduit to the Remote Manual Control Box. Insert cable through conduit connector on one side of the roll pin.

CAUTION **No Corner Pulleys can be used between the 3-way pulley and the Remote Manual Release.**

4. Thread the cable around the bearing.
5. Create a cable loop using a Crimp Sleeve (P/N 214951), and Crimp Tool (P/N 253538).

WARNING **Use of a crimp tool besides P/N 253538 can cause malfunction and/or unwanted discharge of the system.**

Note: In order to ensure the crimp sleeve is secure, the cable must always be looped so that there are two lengths of cable inside the Crimp Sleeve before crimping. Cable must not be spliced anywhere along its length.

6. Place the Crimp Tool on the end of the sleeve. Ensure the flat of the sleeve rests in the saddle of the Crimp Tool jaw. Secure the sleeve in the tool carefully to ensure the sleeve does not shift in the saddle before pressing.
7. Squeeze the handles of the Crimp Tool until the tool releases itself. The tooth of the jaw is pressing on the wall of the sleeve without cracking the malleable copper. The first crimp is complete.
8. Remove the crimp from the tool.
9. Put the Crimp Tool onto the other end of the sleeve. The sleeve shall be 180° turned in the tool from the first crimp.

Note: This is pressing the loop end of the sleeve (opposite that of the first press).

10. Squeeze the handles of the Crimp Tool until the tool releases itself. The tooth of the jaw is pressing on the wall of the sleeve without cracking the malleable copper. The second crimp is complete.
11. Remove the crimp from the tool.
12. Cut the excess cable extending past the cable crimp.
13. Place an S-hook through the loop end of the cable.
14. Attach the S-hook up and through the 3/32-inch (2.5 mm) diameter hole on the upper right side of the control box as shown in Figure 4-69 and Figure 4-70.
15. Slip the pull pin through the slot on the cover plate.

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16. Push the pull pin through the bearing and "U" bracket.

Figure 4-69. Recess Mounted End-of-Line Remote Manual Control, P/N 9197461

Figure 4-70. Recess Mounted End-of-Line Remote Manual Control (Side View), P/N 9197461

CAUTION **No Corner Pulleys can be used between the 3-Way Pulley and the Remote Manual Release.**

17. Before replacing the cover plate, a lead seal and wire (or equivalent) must l the ring on the pull pin and through the small hole on the bracket.

Note: A 3-Way Pulley (P/N 9197602) CANNOT be used to operate dual gas val Way Pulley can be used in a given detection system and must be counte Pulleys.

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4-4.4.5 CABLING MECHANICAL GAS VALVE IN THE UCH CONTROL SYSTEM

Note: The following instructions assume that the cabling will begin fro valve).

The gas valve cable is easier to attach while the Cam/Flag is in the gas valve cable adjustment must take place when the Cam/Flag is in valve should be set only after setting the Cam/Flag.

1. Bringing the control cable in from the valve, carefully insert the end of the cable into the hole in the end of the trigger.
2. Pull enough cable through so that there is slack on the outlet side of the trigger. Slip a Cable Crimp (P/N 214951) over the end of the cable.
3. Making a loop, slip the end back through the Cable Crimp. Use the Crimping Tool (P/N 253538) to fasten the Cable Crimp to the cable. Cut the loop off of the crimped cable assembly. Cut any loose ends off as close to the Crimp Sleeve as possible.
4. Pull the cable back through so the crimp rests at the trigger (see Figure 4-71).

Figure 4-71. Cabling Gas Valve (Cam/Flag in 'Released' State)

To set the gas valve, use the Keeper Pin (P/N 9197108) to set Cam/Flag and lock it into the 'Set' position. The gas valve can now be set and adjusted.

To set the gas valve later, the system must be completely set up, with all detection lines in the 'Set' position. The Cam/Flag can then be set and the gas valve can be properly adjusted.

CAUTION **Only Tee Pulleys (P/N 843791) can be used to operate Dual Gas Valves.**

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4-4.4.5.1 CABLING MECHANICAL GAS VALVE

1. To set the gas valve, use the Keeper Pin (P/N 9197108) to set Cam/Flag and position.

Figure 4-72. Cabling Gas Valve (Cam/Flag in 'Set' State)

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2. Remove top and bottom knockouts from the 2x2 electrical box. Install top hole of the electrical box (see Figure 4-75).
3. Mount the electrical box to the wall using appropriate hardware.
4. Run conduit and install Corner Pulleys (where appropriate) from the l
5. Install the gas valve to the electrical box using the washer and nut pro
6. Slip a Cable Crimp (P/N 214951) over the end of the cable.
7. Insert the cable through the gas valve stem.
8. Making a loop, slip the end back through the Cable Crimp.
9. Pull on the cable to lift the gas valve to the open position.

CAUTION **When pulling on the cable to lift the gas valve, do not over adjust the gas valve.**

10. Use the Crimping Tool (P/N 253538) to fasten the Cable Crimp to the cable. Cut the loop off of the crimped cable.

Figure 4-73. Installing Mechanical Gas Valve

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4-4.4.6 CABLING MECHANICAL GAS VALVE IN THE A+ CONTROL BOX

The A+ Control Box can close one mechanical gas valve upon actuation by relax
(2 mm) stainless steel cable installed from the gas valve through conduit and C
hole on the valve body lever, next to the spring connection (Figure 4-74).

1. Ensure the Keeper Pin is installed.
2. Remove plug from hole “C” on the side of the A+ Control Box.
3. Connect 1/2-inch (13 mm) EMT to hole “C” on the side of the A+ Control Box (Figure 4-74).
4. Thread the control cable into the bottom hole ("C").
5. Thread the control cable through the hole in the end of the lever next to the spring connection (opposite of the lever end that is connected to the detection cable).
6. Tighten the lever set screw onto the control cable.

Note: It is recommended that you cut the control cable close to the lever.

Figure 4-74. Cabling Mechanical Gas Valve Cable in the A+ Control Box

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4-4.4.6.1 CABLING MECHANICAL GAS VALVE

1. To set the gas valve, use the Keeper Pin (P/N 9197108) to set the leve position.
2. Remove top and bottom knockouts from the 2x2 electrical box. Install top hole of the electrical box (see Figure 4-75).
3. Mount the electrical box to the wall using appropriate hardware.
4. Run conduit and install Corner Pulleys (where appropriate) from the electrical box to the A+.
5. Install the gas valve in the electrical box using the washer and nut provided with the gas valve.
6. Slip a Cable Crimp (P/N 214951) over the end of the cable.
7. Insert the cable through the gas valve stem.
8. Making a loop, slip the end back through the Cable Crimp.
9. Pull on the cable to lift the gas valve to the open position.

CAUTION **When pulling on the cable to lift the gas valve, do not over adjust the gas valve.**

10. Use the Crimping Tool (P/N 253538) to fasten the Cable Crimp to the cable. Cut the loop off of the crimped cable.

Figure 4-75. Installing Mechanical Gas Valve

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4-4.4.7 ELECTRICAL GAS VALVE, P/N 9197XXX

Electric Gas Valve is controlled by a pressure switch or microswitch and the Man (P/N 9101735), see Figure 4-77 and Figure 4-78). For Manual Reset Relay Box us Figure 4-79 and Figure 4-80. A loss of electrical power will cause the Electric Ga

All Electric Gas Valves must be installed horizontally with the solenoid up.

Note: All wiring connections shall be made outside of the solenoid box on the electric gas valve.

Figure 4-76. Electric Gas Valve, P/N 9197XXX

CAUTION **A manual reset relay box is necessary when using an electrical gas valve.**

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Figure 4-77. Manual Reset Relay Box, P/N 9101735

Figure 4-78. Manual Reset Relay Wiring Detail

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MANUAL RESET RELAY BOX

MANUAL RESET RELAY BOX (OPEN)

Figure 4-79. Manual Reset Relay Box, P/N 9101735 (Used Before 2006)

Figure 4-80. Manual Reset Relay Wiring Diagram

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4-4.4.8 INSTALLING PNEUMATIC RELEASE, P/N 9189412

1. Fasten 12-inch vertical riser to a tee. The purpose of the 12-inch riser is during discharge to prevent the entrance of Wet Chemical into the Pne
2. Mount to the wall using suitable hardware.
3. Remove three (3) knockouts from a 4x4 electrical box as illustrated in
4. Mount the 4x4 electrical box to the wall using suitable hardware.
5. Install 1-1/2-inch x 1/4-inch NPT nipple into the pneumatic release.
6. Install a spacer or 1-1/4-inch fender washers (usually four or five) on the nipple and pneumatic release. This ensures the pneumatic release is aligned in the 4x4 box.
7. Place the pneumatic release through the center knockout of the 4x4 electrical box as shown in Figure 4-81. The 1-1/2-inch x 1/4-inch NPT nipple should extend outside the electrical box.
8. Install a spacer or 1-1/4-inch fender washer(s) on the 1/4-inch nipple and electrical box. This ensures the space between the reducer and the 1/4-inch NPT nipple will be aligned and secured in the 4x4 box.
9. Install reducer and tighten until pneumatic release is secure inside the electrical box.
10. Attach the vertical riser, tee, and piping to the reducer and tighten. Refer to Figure 4-81.
11. After the Pneumatic Release is installed, push in the piston rod to make sure it moves freely.
12. Install conduit and Corner Pulleys from the window, door, or other ventilating device being closed to the safety pin on the Pneumatic Release in such a manner that the cable pull on the safety pin will be in a straight line and perpendicular to the stem.
13. Route the 1/16-inch control cable through conduit and Corner Pulleys. Connect cable ends to plunger and mechanical release at device.
14. Slip a Cable Crimp (P/N 214951) over the end of the cable.
15. Insert the cable through the gas valve stem.
16. Making a loop, slip the end back through the Cable Crimp.
17. Pull on the cable to lift the gas valve to the open position.
18. Adjust the length of the cable so that the gas valve is in the fully opened position when the "S" hook is placed on the piston rod of the Pneumatic Release. Secure the cable with a crimp or cable block. Refer to Figure 4-81.

Ensure that sufficient cable (1-inch (25 mm) minimum) is exposed at the pneumatic release between the crimp and the 1/2-inch (13 mm) EMT to allow full travel of the stem when the pneumatic release operates.

A maximum of two Pneumatic Releases may be installed off of one 12-inch (305 mm) vertical riser by the use of a tee on top of the riser and the pneumatic released installed one on each side of the tee.

The piping used to plumb the Pneumatic Release must be included in the total volumetric calculation for the overall discharge piping. The piping may be:

- 1/2-inch (13 mm),
- 3/8-inch (10 mm),
- or 1/4-inch (6 mm) black pipe.

The tee used with the Pneumatic Release is to be accounted for when calculating equivalent feet. The maximum number of Pneumatic Releases permitted in a single system is 20.

Note: When using the A+, the Pneumatic Release must be used when operating two (2) or more spring-loaded fail-close gas valves.

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The Pneumatic Release requires 35 PSI (241 kPa) for operation.

Note: The Pneumatic Release may be installed anywhere in the agent distr

Figure 4-81. Example of a Pneumatic Release Installation

4-5 POST-INSTALLATION CHECKOUT

Note: Badger Fire Protection recommends that all system installations l
photos for future reference.

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The Range Guard Wet Chemical System must be checked for proper installa
it can be put into service. The goal of the initial inspection is to verify
adequate for the application and that the installation conforms to the instru
17A and NFPA 96 and this manual. The inspection must cover the following parts of the system:

- Extinguishing System
- Piping System
- Detection System
- Control System
- Mechanical System

At this point, the Range Guard Wet Chemical System should be configured as follows:

- Cylinder mountings are secure.
- Discharge Adapter Kits are secure.
- Valve Protection Plates are attached to the top of the cylinder valves.
- Nozzles are secure.
- For Mechanical Actuation:
  - Detectors are secure and properly placed.
  - Remote Manual Releases are secure and in the ready mode.
  - All conduit and Corner Pulleys are secure, and all Corner Pulleys capped.
- For Electrical Actuation:
  - Ensure that the Solenoid is secure.
  - Check the fire control panel. Ensure that it is operational and in standby mode.
- SVAs are secured to the copper tubing and are not connected to the cylinder valves.
- The High-Pressure Nitrogen Tubing from the UCH Control System is ***not*** connected to the UCH Control System outlet.
- The UCH Control System contains no cartridges, neither the System Test Cartridge, nor the System Nitrogen Cartridge.
- The detection lines are in the 'Released' position.
- The Cam/Flag is in the 'Released' position.

4-5.1 Extinguishing System Visual Inspection

The purpose of this inspection is to ensure that the system is designed according to all applicable standards. The inspection must address the following issues.

1. Is the type and quantity of wet chemical used adequate to extinguish the type of fire presented during risk assessment and review of application?
2. Are the Mounting Brackets securely fastened to a wall or other structural member?
3. Are all Cylinder and Valve Assemblies ready for installation?
   a. Are all pressure gauges in the operating (“green”) range?
   b. Are all cylinders in good condition, without evidence of corrosion or damage?
   c. Are all nameplates in place?
4. Has the agent distribution piping been cleaned and inspected (internally) to remove oil or particulate matter that could affect agent discharge? Refer to agent distribution piping checkout procedures.

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5. Does the agent distribution piping comply with the design parameters in thi
    a. Are all pipe lengths and equivalent pipe lengths within specified limit
    b. Are the specified piping material and fittings installed?
    c. Is the 1/2-inch vent plug installed correctly?
6. Are piping joints, discharge nozzles and pipe supports securely fastened to p leakage or hazardous movement during discharge?
7. Are all discharge nozzles applicable to the type of coverage required?
    a. Are all nozzles properly aimed and secured?
    b. Are all nozzles spaced within parameters listed in this manual?
    c. Are all nozzles clean?

4-5.2 Agent Distribution Piping Checkout

WARNING

Do not use oxygen to blow out piping. The use of oxygen is very dangerous as the possible presence of even a minute quantity of oil may cause an explosion, thereby causing death, serious personal injury and/or property damage.

The agent distribution piping must be blown clear with dry air or nitrogen to clean out the system and to check for any leaks or obstructions. One possible method is as follows:

1. Pressurize empty test cylinders with nitrogen or dry air to approximately 100 PSIG (6.89 bar).
2. Be sure that nozzle foil seals are attached to all nozzles.
3. Remove Wet Chemical Cylinder and Valve Assemblies from the Discharge Adapters and brackets.
4. Attach the test cylinders to the Discharge Adapters.
5. Discharge its contents into the piping system.
6. Verify that all nozzle foil seals are broken.
7. Remove all nozzles from the system and clean out any debris.
8. Re-install all nozzles and replace all nozzle foil seals.
9. Re-install the Cylinder and Valve Assemblies and the Discharge Adapters.

4-5.3 Detection System Inspection

The purpose of the detection system inspection is to ensure that the system is properly installed and designed.

1. Have temperature changes created by process start-up conditions been measured and accounted for?
2. Has a temperature survey been conducted to determine the maximum ambient temperature in the protected area?
3. Have the detectors been installed in a neat, professional manner, and in accordance with the technical data in this manual?
    a. Are all detection system signal lines (cable, wiring, or tubing) properly installed in conduit or EMT?
    b. Has a point-to-point check for signal line continuity been conducted?
4. Is the Remote Manual Release(s) located in a path of exit or egress and is it clearly identified?

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4-5.4 Mechanical Systems Inspection (UCH and A+)

The Control System must be checked for proper connection to external co
properly set prior to the final system checkout. Before setting the Control

1. All stainless steel cable to detectors and Remote Manual Release(s) is
   EMT. Conduit runs must be clean and secure.
2. All cable runs to external components enter the proper Control Syste
   are installed in accordance with the instructions in Chapter 4.
3. There is no branching in the cabling to the detectors.
4. Stainless steel control cable lengths, and Corner Pulleys, Tee Pulleys, and 3-Way Pulleys counts are within listed parameters.
5. Inspect copper tubing and fittings.
6. Ensure nitrogen actuation lines are within listed parameters.

Next step is commissioning the system.

- If UCH, go to Paragraph 4-6
- If A+, go to Paragraph 4-7

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4-6 COMMISSIONING THE SYSTEM - UCH CONTROL SYSTEM

Perform the "Post-Installation Checkout" on page 4-81.

4-6.1 Arming the System

Set the detection beams by turning the ratchet spools counterclockwise (see Figu

Tighten the line until the beam reaches the Stop. **Do not overtighten**.

Note: In long cable lines (over 125 ft. [38 m]) there will be stretch in the control cable and in the loops for the detectors. It is important to ensure the control cable is tight without over tightening.

CAUTION **The actuation latch must be in the horizontal position. If it is in any position other than horizontal, the system could malfunction.**

DETECTION BEAMS IN RELEASED POSITION

DETECTION BEAMS IN SET POSITION

Figure 4-82. Setting the Detection Beams

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Figure 4-83. Detection Beam Stops

CAUTION

If the Remote Manual Release control cable is interfering with the free movement of the actuation latch, it might require re-cabling. If there is something else interfering with the free movement of the actuation latch, take appropriate corrective action. If it is determined that the interference is due to a mechanical fault of the UCH Control System, it must be replaced and returned to the factory.

Be careful not to allow the control cable to become entangled with any other parts in the system. If it does, perform the following steps.

1. Using a 7/8-inch socket (or equivalent), slightly turn the ratchet spool counterclockwise. Do not turn so far that it will click into the next step. Using the thumb release on the pawl, release the ratchet and allow it to turn slowly clockwise. The beam will move back to the 'Released' position.

Figure 4-84. View of Ratchet Spool and Pawl

2. Untangle the control cable and guide it onto the spool while ratcheting. Once there is tension, there should be no more entanglement.
3. Using a 7/8-inch socket (or equivalent), carefully ratchet up the slack in the control cable lines (see Figure 4-85). Tighten the line until the beam reaches the stop. **Do not overtighten**.

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Figure 4-85. Detection Beam Stops

Note: The actuation latch should now be in the horizontal ('Set') position. If it is not, check to ensure the Remote Manual Release control cable is not interfering with the actuation latch and that the actuation latch swings freely.

Figure 4-86. Position of Detection Beams in 'Set' Position

When the two tensioned lines are set, the actuation latch will automatic
position.

Twist the Cam/Flag 90° clockwise until it clicks into place. The actuatior
reset into the horizontal position (see Figure 4-87). Install Keeper Pin in th

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Figure 4-87. Latch Shown in "Set' Position

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4-6.1.1 CHECKING MICROSWITCHES

Check to ensure that the microswitches are set. The Cam/Flag should hold do
Microswitch paddles. The trigger pin should hold up the Deep Mounted Microsw
the microswitch paddles toward the body of the microswitches. If there is a “clic
is not adjusted properly in the UCH Control System. Make appropriate adjustm

CAUTION

The trigger pin on the Deep Mounted Microswitches must be underneath the paddle(s) of the microswitch. If the paddle is under the trigger pin, the microswitch will not change position upon actuation of the UCH Control System and the paddle(s) might be bent or broken upon such actuation.

Figure 4-88. High Mount Microswitch, 'Released' and ‘Set’ Positions

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Figure 4-89. Deep Mount Microswitch, 'Released' and 'Set' Positions

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4-6.1.2 CHECKING SOLENOID

If applicable, ensure that the Solenoid (if installed) is in the de-energized state anc is horizontal.

Manually test the Solenoid by pushing the Solenoid piston to engage the actuatio the Cam/Flag to rotate to the 'Release' position.

WARNING **While performing the manual test of the Solenoid, the rotation of the cam/flag could cause personal injury.**

4-6.1.3 CHECKING GAS VALVE

When the Cam/Flag is in the 'Set' position, verify the gas valve is in the open position.

When the Cam/Flag is in the 'Release' position, verify the gas valve is in the closed position.

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4-6.2 Functional Testing of the UCH Control System

Perform the "Post-Installation Checkout" on page 4-81.

4-6.2.1 TEST MECHANICAL LINK LINES FOR THE UCH CONTROL SYSTEM

To test the mechanical detector lines, perform the following steps.

CAUTION

The mechanical detector lines are under tension. Wearing safety glasses and gloves is required during this process.

Before cutting a detector, ensure the System Nitrogen Cartridge is not installed in the UCH Control System and the Keeper Pin is in place in the Cam/Flag.

1. Remove the Keeper Pin from the Cam/Flag.
2. Go to the far end of the detection line. Cut the detector.
3. Check to ensure the rotation of detection spool and beam assembly as intended.
4. Check to ensure the Cam/Flag has rotated to the 'Release' position.
5. Check the microswitches to ensure that they have changed phase as intended.
6. Check the gas valve line to ensure that it has moved freely and that the gas valve has closed. Verify that all gas fired appliances have shut down, including the pilot lights.
7. Check each detector and bracket to ensure the travel distance of the cable. Make sure the line has operated without interference at any place in the system.
8. Replace detector that was cut.
9. Reset detector line.
10. Check and ensure the actuation latch is reset back to the horizontal position. Reset the Cam/Flag.
11. Insert Keeper Pin into Cam/Flag.
12. Reset all electrical shut-offs.

Repeat steps 1 through 12 for second detection line, if applicable.

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4-6.2.2 TEST REMOTE MANUAL RELEASE, P/N B875572 (IF APPLICABLE)

CAUTION

Before testing the Remote Manual Release, ensure the System Nitrog installed in the UCH Control System and remove the Keeper Pin from

1. Operate the Remote Manual Release by pulling the safety pin located on the release handle and then pulling on the handle.
2. Observe the length of control cable that comes out of the Remote Manual Release. It should be between 3 and 4 inches (76 and 102 mm).
3. Insert the release handle back into the Remote Manual Release.

CAUTION

It is important that the control cable slips easily through the hole in the end of the actuation latch. The actuation latch must be able to operate without interference from the control cable. Be sure to test the movement of the actuation latch assembly before completing the setting of the UCH Control System. 1-1/4 inch (32 mm) to 1-1/2 inch (38 mm) of control cable (with crimp end not included) should be left under the actuation latch, when in the 'Released' position.

4. Go to the UCH Control System and check to ensure the Crimp Sleeve is against the bottom of the actuation latch and the actuation latch is pulled up at approximately two o'clock position and Cam/Flag is in the 'Release' position.
5. Pull 1-1/2-inches of control cable back into the UCH Control System.

4-6.2.3 TEST SOLENOID, P/N B100034 (IF APPLICABLE)

CAUTION

Before testing the Solenoid, ensure the System Nitrogen Cartridge is not installed in the UCH Control System and that the Keeper Pin is in place in the Cam/Flag.

Note: If there is no Solenoid installed in the system, proceed to Paragraph 4-6.2.4.

The instructions for testing electrical releasing of the system will be found in the Design, Installation and Maintenance (DIOM) Manual for the fire control panel being used. A complete functional test shall be accomplished according to that manual and NFPA 72.

1. Remove Keeper Pin.
2. Following the instructions in the DIOM manual of the fire control panel, test the electrical operation of the UCH Control System. It will be important to observe all time delays, alarm and releasing features.
3. Verify actuation of the UCH Control System.
4. Check the microswitches to ensure that they have changed phase as intended.
5. Check the gas valve line to ensure that it has moved freely and that the gas valve has closed. Verify that all gas fired appliances have shut down, including the pilot lights.
6. Ensure that the fire control panel has been reset according to the DIOM Manual for the fire control panel being used. The Solenoid should be de-energized.
7. Check and ensure the actuation latch is reset back to the horizontal position. Reset the Cam/Flag.
8. Insert Keeper Pin into port on Cam/Flag.
9. Reset all electrical shut-offs.

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4-6.2.4 INSPECT HIGH-PRESSURE NITROGEN TUBING

To perform an inspection of the High-Pressure Nitrogen Tubing, use the fc

1. Ensure Keeper Pin is in the Cam/Flag.
2. Ensure that all fittings are tightly attached.

CAUTION

It is important to verify that the UCH Control System is in the 'Set beams must be against their respective stops. The actuation latch must be in the horizontal position and the Cam/Flag in the 'Set' position. The Keeper Pin must be in place in the Cam/Flag.

3. Check all of the SVA pistons to ensure that they are in the set position.

   The bottom surface of the piston must be in the body of the SVA. If it is in the released position, push the piston in while pushing the piston into the body of the SVA (see Figure 4-90).

Recommendation: Badger recommends that the actuation testing take place before the full test.

Figure 4-90. SVA in 'Set' Position

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4-6.3 Actuation Test For the UCH Control System

1. After ensuring that the system is in the 'Set' position and the Keeper Pin is Test Cartridge (P/N 87-120044-001). Carefully install the cartridge into the v UCH Control System. Tighten until cartridge is snug (see Figure 4-91). perform this test with the System Cartridge.

CAUTION

Do not attempt to push the piercing pin down. Pushing the piercing pin t O-ring to move out of the valve bore. This could cause the O-ring to chip or break upon actuation of the system. Inserting the System Nitrogen Cartridge will push the piercing pin down to the proper location in the valve bore.

Note: Do not use a wrench or other tool to tighten the cartridge. Hand tightening is sufficient. If leakage is observed, check the condition of the flat gasket in the valve bore.

Figure 4-91. UCH Control System, Test Cartridge Placement

2. Locate the cover of the UCH Control System. Ensure that the local manual handle is set and that the Safety Pin is inserted (see Figure 4-92). The handle should be locked in the set position. If the handle can turn, adjust until the pin can be inserted all the way through the handle into the body of the cover.

Note: Installation of a tamper wire seal can prevent the pin from slipping out.

3. Remove the Keeper Pin from the UCH Control System Cam/Flag. Carefully install the cover onto the enclosure. The cover has a tongue that fits into the groove of the enclosure. Center the cover over the enclosure and fit the tongue and groove together.

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CAUTION

While the cover is resting on the enclosure, moving it upward manual release with the latch, causing the UCH Control System t as centered as possible while performing this step.

4. Fasten the cover to the enclosure with the captive screws. Turn the ca

Note: The Valve Protection Plates should remain on the top of the Cylin until directed to remove it.

5. Attach the High Pressure Nitrogen Tubing.

Figure 4-92. UCH Control System, Cover Attached

6. Pull the safety pin and turn the handle in the direction of the arrow about 1/8-turn. The system will fire, pressurizing the actuating lines.

Note: Do not loosen any of the fittings on the actuating lines at this time.

7. Inspect the actuating lines and SVAs for leakage. Each SVA piston must be in the released position (down) and locked. Check each piston to ensure that it is fully extended.

Note: If any leakage is observed, appropriate steps must be taken to implement corrective action. However, pressure should be bled off before any action is implemented on the actuating lines.

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WARNING

The system uses high pressure. Safety goggles or glasses must be worn

All pressure must be released from the actuation lines before resett Failure to do so will cause the head of the piercing pin to protrude out exposing the O-ring. This could result in the O-ring being damaged malfunction or non-function of the system as designed. Always ensure has been released before resetting the Cam/Flag.

8. After ensuring there is no leakage, loosen the swivel fitting located at the bottom right side of the UCH Control System (see Figure 4-93). Allow the pressure to vent slowly. When the pressure is completely vented, disconnect the fitting and remove the cover.

CAUTION

To avoid accidental discharge later in the service sequence, it is important to completely disconnect the fitting outside the UCH Control System.

Figure 4-93. Fitting on Outside of UCH Control System

9. Remove the spent cartridge used for the functional test.

10. Discard the spent cartridge in an appropriate manner. Check to ensu set. Refer to Paragraph 4-6.3.1.
11. Reset the Cam/Flag and reinstall the Keeper Pin into the Cam/Flag.

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Note: Ensure the microswitches are setting properly. Check the Deep ensure the trigger pin is under the paddles of the microswitches Check the High Mount Microswitches to ensure the Cam/Flag is pus

12. Install the Safety Pin into the local manual release handle of the cover assembly. Install a tamper indicator through the Safety Pin and around the handle.
13. Reset all of the SVAs. Push the piston in while pushing the piston into the body of each SVA.
14. Carefully remove the Valve Protection Plate from the cylinder valves and install the SVA to each cylinder. Secure with the bolts included. Ensure that each SVA is securely tightened.

CAUTION

A System Nitrogen Cartridge is required for final system set up. Using any other cartridge could cause malfunction or non-function of the system.

Note: Check the condition of the flat gasket in the valve bore. Do not use a wrench or other tool to tighten the cartridge. Hand tightening is sufficient.

Figure 4-94. Valve Body with Flat Gasket

15. When all SVAs are secured, locate the System Nitrogen Cartridge (P/N 87-120043-001). In the area provided, write the date of installation of the cartridge. Carefully install the System Nitrogen Cartridge into the valve assembly of the UCH Control System. Hand-tighten until it is snug.
16. Locate the cover of the assembly. Ensure the tamper seal remains intact in the safety pin.
17. Remove the Keeper Pin from the Cam/Flag.
18. Carefully install the cover onto the enclosure. The cover has a tongue that fits into the groove of the enclosure. Center the cover over the enclosure and fit the tongue and groove together.

CAUTION

While the cover is resting on the enclosure, moving it upward could engage the local manual release with the actuation latch, causing the UCH Control System to release. Keep the cover as centered as possible while performing this step.

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19. Fasten the cover to the enclosure with the captive screws. Turn the captive s

CAUTION

Securing the High Pressure Nitrogen Tubing onto the UCH Control Sy the setup of the Range Guard System. System discharge could occur if been properly set.

20. Secure the High Pressure Nitrogen Tubing back onto the bottom of the U Ensure that the fit is properly snug to prevent leakage. Refer to Figure 4-95.
21. Apply labels to the cover of the UCH Control System.

Figure 4-95. Cylinder Mounted UCH Control System

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4-6.3.1 DISPOSAL OF CARTRIDGE

Following are the recommended instructions for disposal of spent cartridg

WARNING

Never dispose of a pressurized cartridge. Cartridges must discarding. Filled gas cartridges may be dangerous if not handl cartridges above 120°F (49°C). Pressurized cartridges that explode, and thereby cause property damage, severe personal in

Determine if gas is present in the cartridge. All puncturable type disposable cartridges are presumed to be fully charged unless the small puncturable end (opposite of the rounded bottom) is **clearly punctured**. If the puncture is not clear, the cartridge may be weighed using a scale capable of reading in grams accurate to 0.1 g. **The weight of the cartridge shall be less than the indicated weight imprinted on the side of the cartridge by the amount of the indicated charge.**

After using one of the methods described to determine that no gas is present in the cartridge, the cartridge may be placed with normal refuse, or may be placed with steel recycling materials. All of the steel cartridges are produced from a low carbon (14) steel product. Once empty, no residue remains. Cross cutting or sectioning is not required.

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4-7 COMMISSIONING THE A+ CONTROL SYSTEM

Perform the "Post-Installation Checkout" on page 4-81.

4-7.1 Arming the System

If the Keeper Pin does not slide out easily, not enough cable slack was removed pulled through the valve body lever. Loosen the adjusting screw in the Cable Tensi

Note: It is recommended that you cut the detection cable close to the lever.

Figure 4-96. A+ Control Box in "SET" Position

After completing the tensioning of the detection system, make sure that each detector has the required 3 inches (76 mm) minimum spacing, in the direction of cable travel, between the cable clamp or block and the end of the conduit fitting in the detector bracket.

4-7.1.1 CHECKING MICROSWITCHES

Check to ensure that the microswitches are set. Adjust the microswitch toward the lever until the paddle on the microswitch just touches the top corner of the microswitch body. The microswitch is now in the 'Set' position.

4-7.1.2 CHECKING GAS VALVE

When the lever is in the 'Set' position, verify the gas valve is in the open position.

When the lever is in the 'Discharge' position, verify the gas valve is in the closed position.

4-7.1.3 CHECKING SYSTEM VALVE ACTUATOR CONNECTION

Check to ensure that the copper tubing is tighten at the valve body and at the SVA.

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4-7.2 Functional Testing of the A+ Control Box

Perform the "Post-Installation Checkout" on page 4-81.

4-7.2.1 TEST MECHANICAL LINK LINES FOR THE A+ CONTROL BOX (IF AF

To test the mechanical detector lines, perform the following steps.

CAUTION

The mechanical detector lines are under tension. Wearing safety glasses and gloves is required during this process.

Before cutting a detector, ensure the CO_2 Cartridge is not installed in the A+ Control Box and the Keeper Pin is in place in the valve body.

1. Remove the Keeper Pin from the valve body.
2. Go to the far end of the detection line. Cut the detector.
3. Check to ensure the lever has rotated to the 'Discharge' position.
4. Check the microswitches to ensure that they have changed phase as intended.
5. Check the gas valve line to ensure that it has moved freely and that the gas valve has closed. Verify that all gas fired appliances have shut down, including the pilot lights.
6. Check each detector and bracket to ensure the travel distance of the cable. Make sure the line has operated without interference at any place in the system.
7. Replace detector that was cut.
8. Reset detector line.
9. Check and ensure the lever is reset back to the 'Set' position.
10. Insert Keeper Pin into valve body.
11. Reset all electrical shut-offs.

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4-7.2.2 TEST REMOTE MANUAL RELEASE, P/N 9197463 (IF APPLICABLE)

CAUTION

Before testing the Remote Manual Release, ensure the CO_2 Cartridge is A+ Control Box and remove the Keeper Pin from the valve body.

1. Operate the Remote Manual Release by removing the pull pin.
2. Go to the A+ Control Box and check to ensure the lever is in the 'Discharge' position.

4-7.2.3 TESTING MICROSWITCHES (IF APPLICABLE)

CAUTION

Before testing the microswitches, ensure the CO_2 Cartridge is not installed in the A+ Control System and that the Keeper Pin is in place in the valve body.

Note: If there are no microswitches installed in the system, proceed to Paragraph 4-7.2.4.

1. Remove Keeper Pin.
2. Verify actuation of the A+ Control System and the lever is in the 'Discharge' position.
3. Using a voltmeter, check the microswitches to ensure that they have changed phase as intended.
4. Check the gas valve line to ensure that it has moved freely and that the gas valve has closed. Verify that all gas fired appliances have shut down, including the pilot lights.
5. Ensure that the fire control panel has been reset according to the DIOM Manual for the fire control panel being used.
6. Check and ensure the lever is reset back to the 'Set' position.
7. Insert Keeper Pin into port on valve body.
8. Reset all electrical shut-offs.

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4-7.2.4 INSPECT 1/4 in. O.D. COPPER TUBING

To perform an inspection of the copper tubing, use the following steps.

1. Ensure Keeper Pin (P/N 9197108) is in the valve body.
2. Ensure that all fittings are tightly attached.

CAUTION

It is important to verify that the lever is in the 'Set' position and [illegible] in place in the valve body.

3. Check all of the SVA pistons to ensure that they are in the set position.

   The bottom surface of the piston must be in the body of the SVA. If it is in the released position, push the piston into the body of the SVA (see Figure 4-97).

Recommendation: Badger recommends that the actuation testing take place before the full test.

Figure 4-97. SVA in 'Set' Position

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4-7.2.5 INSTALLING THE CO_2 GAS CARTRIDGE IN THE A+ CONTROL BOX

After the gas valve connection has been made and the optional microswitch(es cartridge must be installed.

1. In the area provided, write the date of installation of the CO_2 cartridge. Care cartridge into the valve body of the A+. Hand-tighten until it is snug.

CAUTION **If the CO_2 cartridge is not sealed against the valve gasket, or the valve gasket is missing, the system will not function properly. Verify correct installation.**

2. Remove Keeper Pin.

CAUTION **Be sure to remove the Keeper Pin. Failure to remove the Keeper Pin will result in an inoperative system.**

After initial installation, perform the actuation test described in Paragraph 4-7.3.

Figure 4-98. Installing CO_2 Gas Cartridge

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4-7.3 Actuation Test for the A+ Control Box (If Applicable)

CAUTION

The mechanical detector lines are under tension. Wearing safety glas during this process.

1. Remove the System Valve Actuator (SVA) from each Range Guard valve and cylinder assembly. Leave the copper tubing connected to the SVAs.
2. Go to the far end of the detection line. Cut the detector.
3. Check the CO_2 cartridge to ensure it has discharged.
4. Check the microswitches to ensure that they have changed phase as intended.
5. Check the gas valve line to ensure that it has moved freely and that the gas valve has closed. Verify that all gas fired appliances have shut down, including the pilot lights.
6. Check each detector and bracket to ensure the travel distance of the cable. Make sure the line has operated without interference at any place in the system.
7. Reset all electrical shut-offs.

CAUTION

This step must be done before the A+ Control Box is reset, otherwise the valve body O-ring could be damaged.

8. Carefully release residual pressure in the copper tubing line by slightly loosening a tubing nut.
9. Retighten the tubing nut after all the residual pressure is released.
10. Reset all of the SVAs. Push the piston into the body of the SVA.
11. Reset the A+ Control Box by installing the Keeper Pin as previously stated.
12. Remove and discard the used CO_2 cartridge. Refer to Paragraph 4-7.3.1.
13. In the area provided, write the date of installation of the cartridge.
14. Carefully install the CO_2 cartridge into the valve body of the A+ Control Box. Hand-tighten in until it is snug.

CAUTION

If the CO_2 cartridge is not sealed against the gasket or the gasket is missing, the system may not function properly.

15. Remove Keeper Pin.

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16. Secure the cover to A+ Control Box, making sure that the lever is visible in cover and in the 'Set' position.

CAUTION

Be sure to remove the Keeper Pin. Failure to remove the Keeper Pi inoperative system.

Figure 4-99. A+ with Cover Installed

17. Apply labels to the cover of the A+ Control Box.

4-7.3.1 DISPOSAL OF CARTRIDGE

Following are the recommended instructions for disposal of spent cartridges.

WARNING

Never dispose of a pressurized cartridge. Cartridges must be discharged before discarding. Filled gas cartridges may be dangerous if not handled properly. Do not heat cartridges above 120°F (49°C). Pressurized cartridges that become overheated can explode, and thereby cause property damage, severe personal injury, and possibly death.

Determine if gas is present in the cartridge. All puncturable type disposable cartridges are presumed to be fully charged unless the small puncturable end (opposite of the rounded bottom) is **clearly punctured**. If the puncture is not clear, the cartridge may be weighed using a scale capable of reading in grams accurate to 0.1 g. **The weight of the cartridge shall be less than the indicated weight imprinted on the side of the cartridge by the amount of the indicated charge.**

After using one of the methods described to determine that no gas is present in the cartridge, the cartridge may be placed with normal refuse, or may be placed with steel recycling materials. All of the steel cartridges are produced from a low carbon (14) steel product. Once empty, no residue remains. Cross cutting or sectioning is not required.

CHAPTER 5
MAINTENANCE

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5-1 INTRODUCTION

Note: It is the responsibility of the system installer to review system operation and owner obligations, and to provide the owner's manual to the owner at the time of system installation.

This chapter contains the service and maintenance instructions for the Range Guard® Wet Chemical System. These procedures must be preformed regularly, and in accordance with all applicable regulations. If problems arise, corrective action must be taken.

5-2 INSPECTION AND MAINTENANCE PROCEDURES

Use Table 5-1 to identify preventative maintenance schedule of the Range Guard Wet Chemical System.

Table 5-1. Preventative Maintenance Schedule

Schedule	Requirement	Paragraph
Monthly	Owner's Inspection	Paragraph 5-2.1
Semi-Annual	System Inspection by an Authorized Badger Distributor	Paragraph 5-2.2
Every 12 Years	Detailed System Inspection by an Authorized Badger Distributor	Paragraph 5-2.3

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5-2.1 Monthly Inspection Procedure (by Owner)

Refer to the cylinder nameplate for the proper maintenance instructions. In acc
17A and NFPA 96, make frequent inspections to ascertain that the system is ope
that nothing has occurred which would compromise the effectiveness of the syst

The following procedure is to be performed by the Owner of the system.

Table 5-2. Owner's Monthly Inspection

Checkbox	Procedure
☐	Inspect all system components, agent distribution pipe, and conduit runs for physical damage and/or displacement.
☐	Inspect all nozzles to see if foil seal caps (if applicable) are in place. Check for possible obstructions to the discharge of the wet chemical.
☐	Inspect all detectors (Fusible-links and Thermo-bulbs) for contamination. If contamination is found, contact an authorized Badger Distributor for service.
☐	Inspect each Cylinder and Valve Assembly. The pointer on the pressure gauge should be in the "green" range. The cylinder should not show evidence of corrosion or damage.
☐	Inspect manual pull stations are unobstructed and in clear view and labeled for intended use.
☐	Inspect all tamper seals are intact and the system is in a ready condition.
☐	Verify the inspection tag or certificate is in place and current.
☐	A record of the monthly inspection is to be kept reflecting the date inspected, initials of the person performing the inspection, and any corrections required.
☐	If wall mounted, the UCH Control System must be tightly secured to the wall. If cylinder mounted, the UCH Control System must be tightly bolted to the SVA. The Cam/Flag on the UCH Control System indicator should point to the 'Set' position. The safety pin and seal wire on the local manual release handle should be in place. If no Remote Manual Release is installed, the path to the local manual release on the cylinder should be clear and unobstructed and within reach.
☐	If any discrepancies are noted while making this inspection, DO NOT CONTINUE OPERATING HAZARDOUS PROCESSES OR TURN ON PROTECTED EQUIPMENT. Immediately contact an authorized Badger Distributor for service and/or repair.
☐	The hood, duct, and protected cooking appliances have not been replaced, modified, or relocated.

CAUTION

No other action shall be taken by the system owner other than visual. If further maintenance is determined necessary as a result of owner inspection, contact an authorized Badger Distributor.

WARNING

Do not operate hazardous processes or turn on protected equipment until the required system alterations are complete.

WARNING

Any unauthorized alterations to the protected area or equipment, or to the wet chemical system, can render the fire suppression system ineffective or non-operational. Contact an authorized Badger distributor if any modifications are contemplated.

5-2.2 Semi-Annual Service Procedure (By Authorized Badger Distributor On

All systems shall be inspected and serviced semi-annually by an authori using an UCH Control System, start with Paragraph 5-2.2.1. If using the A Paragraph 5-2.2.8.

Refer to NFPA 17A and NFPA 96 for all Semi-Annual maintenance.

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Table 5-3. Semi-Annual Service Procedure

Checkbox	Procedure	Section
☐	Preparation for Servicing and Testing	Paragraph 5-2.2.1
Functional Testing of the UCH Control System		
☐	Test Mechanical Link Lines	Paragraph 5-2.2.6.1
☐	Test Remote Manual Release	Paragraph 5-2.2.6.2
☐	Test Solenoid (if applicable)	Paragraph 5-2.2.6.3
☐	Inspection of High-Pressure Nitrogen Tubing	Paragraph 5-2.2.6.4
☐	Perform Actuation Tests	Paragraph 5-2.2.7
☐	Verify the Corner Pulleys and detector bracket conduit openings are free of grease	N/A
☐	Check that the fan warning sign is legible and conspicuous (if not, replace)	N/A
☐	Disposal of Cartridge	Paragraph 5-2.2.7.1
Functional Testing of the A+ Control Box		
☐	Test Mechanical Link Lines	Paragraph 5-2.2.10.1
☐	Test Remote Manual Release	Paragraph 5-2.2.11
☐	Test Microswitches (if applicable)	Paragraph 5-2.2.12
☐	Inspect 1/4-inch O.D. (6 mm) Copper Tubing	Paragraph 5-2.2.12.1
☐	Perform Actuation Tests	Paragraph 5-2.2.13
☐	Verify the Corner Pulleys and detector bracket conduit openings are free of grease	N/A
☐	Check that the fan warning sign is legible and conspicuous (if not, replace)	N/A
☐	Disposal of Cartridge	Paragraph 5-2.2.13.1

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5-2.2.1 PREPARATION FOR SERVICING AND TESTING THE UCH CONTROL SYSTI

1. Disconnect the high-pressure nitrogen tubing from the UCH Control System

Figure 5-1. High-Pressure Nitrogen Tubing Location, Close Up

2. Verify that the system design and installation are adequate to protect the hazard area and that the installation conforms to the instructions in this manual. Some of the items to verify are:
   a. All equipment requiring fire protection within the hazard area is protected.
   b. There have been no unauthorized alterations to the protected area or equipment, or to the wet chemical system, that render the fire suppression system ineffective or non-operational.
   c. All Cylinder Mounting Brackets are securely fastened to a wall or other structural member.
   d. All nozzles are properly aimed, secured and located within the proper distance from the protected equipment. Each nozzle should be clean and equipped with a foil seal cap (if applicable).
   e. The agent distribution piping is properly sized for the number and type of nozzles required.
   f. All piping joints and pipe supports are securely fastened to prevent wet chemical leakage and hazardous movement during discharge.
   g. The pipe lengths, sizes, fittings and material are as specified in this Manual.
   h. The number, type, and placement of detectors are suitable for all hazards within the hazard area.
   i. The Remote Manual Release, if used, is located in a path of exit or egress and is clearly identified.
   j. Stainless steel control cable lengths and Corner Pulley counts are within listed limits. Conduit runs should be clean and secure.
   k. All wiring is in compliance with local codes.
   l. All field wiring is free of ground fault or short-circuit conditions.

m. No branch circuits exist in the wiring to the detectors or to the

n. All auxiliary components such as Pressure Operated Releases evidence of physical damage.

o. All system components and installation material are as specific

3. Remove the cover from the UCH Control System. Install Keeper Pin. Pin location.

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Figure 5-2. UCH Control System, Internal View

4. Remove the System Nitrogen Cartridge (P/N 87-120043-001). Refer to Figure 5-2 for location in UCH Control System.

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5. Check flat gasket inside valve body. If damaged, replace (see Figure 5-3).

Figure 5-3. Valve Body and Flat Gasket Location

6. Verify installation of the lockout screws for appropriate usage (refer to Figure 5-2).
7. Remove the System Valve Actuators (SVAs) from all cylinders. See Figure 5-4 for location.

Figure 5-4. System Valve Actuators

8. Install cylinder valve protection plates.

9. Disconnect Discharge Adapter Kit (agent piping) from all cylinders (se

Note: Disconnecting the Discharge Adapter Kit typically involves removir

10. Install the Anti-Recoil Plate.

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Figure 5-5. Removing Discharge Adapter Kit

5-2.2.2 ARMING THE UCH CONTROL SYSTEM

Set the detection beams by turning the applicable ratchet spools counterclockwise (see Figure 5-6).

Tighten the line until the beam reaches the Stop. **Do not overtighten**.

Note: In long cable lines (over 125 ft. [38 m]) there will be stretch in the control cable and in the loops for the detectors. It is important to ensure the control cable is tight without over tightening.

CAUTION **The actuation latch must be in the horizontal position. If it is in any position other than horizontal, the system could malfunction.**

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DETECTION BEAMS IN RELEASED POSITION

DETECTION BEAMS IN SET POSITION

Figure 5-6. Setting the Detection Beams

Figure 5-7. Detection Beam Stops

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CAUTION

If the Remote Manual Release control cable is interfering with t actuation latch, it might require re-cabling. If there is something free movement of the actuation latch, take appropriate co determined that the interference is due to a mechanical fault of t it must be replaced and returned to the factory.

Be careful not to allow the control cable to become entangled with any other parts in the system. If it does, perform the following steps.

1. Using a 7/8-inch socket (or equivalent), slightly turn the ratchet spool counterclockwise. Do not turn so far that it will click into the next step. Using the thumb release on the pawl, release the ratchet and allow it to turn backwards. The beam will move back to the 'Released' position.

Figure 5-8. View of Ratchet Spool and Pawl

2. Untangle the control cable and guide it onto the spool while ratcheting. Once there is tension, there should be no more entanglement.
3. Using a 7/8-inch socket (or equivalent), carefully ratchet up the slack in the control cable lines (see Figure 5-9). Tighten the line until the beam reaches the stop. **Do not overtighten**.

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Figure 5-9. Detection Beam Stops

Note: The actuation latch should now be in the horizontal ('Set') position. If it is not, check to ensure the Remote Manual Release control cable is not interfering with the actuation latch and that the actuation latch swings freely.

Figure 5-10. Position of Detection Beams in 'Set' Position

When the two tensioned lines are set, the actuation latch will automatic position.

Twist the Cam/Flag 90° clockwise until it clicks into place. The actuatior reset into the horizontal position (see Figure 5-11). Install Keeper Pin in th

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Figure 5-11. Latch Shown in "Set' Position

5-2.2.3 CHECKING MICROSWITCHES

Check to ensure that the microswitches are set. The Cam/Flag should hold down the High Mount Microswitch paddles. The trigger pin should hold up the Deep Mounted Microswitches. Gently push the microswitch paddles toward the body of the microswitches. If there is a "click," the microswitch is not adjusted properly in the UCH Control System. Make appropriate adjustments.

CAUTION

The trigger pin on the Deep Mounted Microswitches must be underneath the paddle(s) of the microswitch. If the paddle is under the trigger pin, the microswitch will not change position upon actuation of the UCH Control System and the paddle(s) might be bent or broken upon such actuation.

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5-2.2.4 CHECKING SOLENOID

If applicable, ensure that the Solenoid (if installed) is in the de-energized state anc is horizontal.

Manually test the Solenoid by pushing the Solenoid piston to engage the actuatio the Cam/Flag to rotate to the 'Released' position.

WARNING **While performing the manual test of the Solenoid, the rotation of the cam/flag could cause personal injury.**

5-2.2.5 CHECKING GAS VALVE

When the Cam/Flag is in the 'Set' position, verify the gas valve is in the open position.

When the Cam/Flag is in the 'Discharge' position, verify the gas valve is in the closed position.

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5-2.2.6 FUNCTIONAL TESTING OF THE UCH CONTROL SYSTEM

Perform the Post-Installation Checkout procedures in Paragraph 4-5.

5-2.2.6.1 Test Mechanical Link Lines for the UCH Control System (If Applicable

To test the mechanical detector lines, perform the following steps.

CAUTION

The mechanical detector lines are under tension. Wearing safety glasses and gloves is required during this process.

Before cutting a detector, ensure the System Nitrogen Cartridge is not installed in the UCH Control System and the Keeper Pin is in place in the Cam/Flag.

1. Remove the Keeper Pin from the Cam/Flag.
2. Go to the far end of the detection line. Cut the detector.
3. Check to ensure the rotation of detection spool and beam assembly as intended.
4. Check to ensure the Cam/Flag has rotated to the 'Released' position.
5. Check the microswitches to ensure that they have changed phase as intended.
6. Check the gas valve line to ensure that it has moved freely and that the gas valve has closed. Verify that all gas fired appliances have shut down, including the pilot lights.
7. Check each detector and bracket to ensure the travel distance of the cable. Make sure the line has operated without interference at any place in the system.
8. Replace detector that was cut.
9. Reset detector line.
10. Check and ensure the actuation latch is reset back to the horizontal position. Reset the Cam/Flag.
11. Insert Keeper Pin into Cam/Flag.
12. Reset all electrical shut-offs.

Repeat steps 1 through 12 for second detection line, if applicable.

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5-2.2.6.2 Test Remote Manual Release, P/N B875572 (If Applicable)

CAUTION

Before testing the Remote Manual Release, ensure the System Nitrog installed in the UCH Control System and remove the Keeper Pin from

1. Operate the Remote Manual Release by pulling the safety pin located on the release handle and then pulling on the handle.
2. Observe the length of control cable that comes out of the Remote Manual Release. It should be between 3 and 4 inches (76 and 102 mm).
3. Insert the release handle back into the Remote Manual Release.

CAUTION

It is important that the control cable slips easily through the hole in the end of the actuation latch. The actuation latch must be able to operate without interference from the control cable. Be sure to test the movement of the actuation latch assembly before completing the setting of the UCH Control System. 1-1/4 inch (32 mm) to 1-1/2 inch (38 mm) of control cable (with crimp end not included) should be left under the actuation latch, when in the 'Released' position.

4. Go to the UCH Control System and check to ensure the Crimp Sleeve is against the bottom of the actuation latch and the actuation latch is pulled up at approximately two o'clock position and Cam/Flag is in the 'Released' position.
5. Pull 1-1/2-inches of control cable back into the UCH Control System.

5-2.2.6.3 Test Solenoid, P/N B100034 (If Applicable)

CAUTION

Before testing the Solenoid, ensure the System Nitrogen Cartridge is not installed in the UCH Control System and that the Keeper Pin is in place in the Cam/Flag.

Note: If there is no Solenoid installed in the system, proceed to Paragraph 5-2.2.6.4.

The instructions for testing electrical releasing of the system will be found in the Design, Installation and Maintenance (DIOM) Manual for the fire control panel being used. A complete functional test shall be accomplished according to that manual and NFPA 72.

1. Remove Keeper Pin.
2. Following the instructions in the DIOM manual of the fire control panel, test the electrical operation of the UCH Control System. It will be important to observe all time delays, alarm and releasing features.
3. Verify actuation of the UCH Control System.
4. Check the microswitches to ensure that they have changed phase as intended.
5. Check the gas valve line to ensure that it has moved freely and that the gas valve has closed. Verify that all gas fired appliances have shut down, including the pilot lights.
6. Ensure that the fire control panel has been reset according to the DIOM Manual for the fire control panel being used. The Solenoid should be de-energized.
7. Check and ensure the actuation latch is reset back to the horizontal position. Reset the Cam/Flag.
8. Insert Keeper Pin into port on Cam/Flag.
9. Reset all electrical shut-offs.

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5-2.2.6.4 Inspect High-Pressure Nitrogen Tubing

To perform an inspection of the High-Pressure Nitrogen Tubing, use the fc

1. Ensure Keeper Pin is in the Cam/Flag.
2. Ensure that all fittings are tightly attached.

CAUTION

It is important to verify that the UCH Control System is in the 'Set beams must be against their respective stops. The actuation latch must be in the horizontal position and the Cam/Flag in the 'Set' position. The Keeper Pin must be in place in the Cam/Flag.

3. Check all of the SVA pistons to ensure that they are in the set position.
4. The bottom surface of the piston must be in the body of the SVA. If it is in the released position, push the piston into the body of the SVA (see Figure 5-12).

Recommendation: Badger recommends that the actuation testing take place before the full test.

Figure 5-12. SVA in 'Set' Position

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5-2.2.7 ACTUATION TEST FOR THE UCH CONTROL SYSTEM

1. After ensuring that the system is in the 'Set' position and the Keeper Pin is Test Cartridge (P/N 87-120044-001). Carefully install the cartridge into the v UCH Control System. Tighten until cartridge is snug (see Figure 5-13). perform this test with the System Cartridge.

CAUTION

Do not attempt to push the piercing pin down. Pushing the piercing pin t O-ring to move out of the valve bore. This could cause the O-ring to cnip or break upon actuation of the system. Inserting the System Nitrogen Cartridge will push the piercing pin down to the proper location in the valve bore.

Note: Do not use a wrench or other tool to tighten the cartridge. Hand tightening is sufficient. If leakage is observed, check the condition of the flat gasket in the valve bore.

Figure 5-13. UCH Control System, Test Cartridge Placement

2. Locate the cover of the UCH Control System. Ensure that the local manual handle is set and that the Safety Pin is inserted (see Figure 5-14). The handle should be locked in the set position. If the handle can turn, adjust until the pin can be inserted all the way through the handle into the body of the cover.

Note: Installation of a tamper wire seal can prevent the pin from slipping out.

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Figure 5-14. UCH Control System, Cover Attached

3. Remove the Keeper Pin from the UCH Control System Cam/Flag. Carefully install the cover onto the enclosure. The cover has a tongue that fits into the groove of the enclosure. Center the cover over the enclosure and fit the tongue and groove together.

CAUTION

While the cover is resting on the enclosure, moving it upward could engage the local manual release with the latch, causing the UCH Control System to release. Keep the cover as centered as possible while performing this step.

4. Fasten the cover to the enclosure with the captive screws. Turn the captive screws until snug.

Note: The Valve Protection Plates should remain on the top of the Cylinder and Valve Assemblies until directed to remove it.

5. Pull the safety pin and turn the handle in the direction of the arrow about 1/8-turn. The system will fire, pressurizing the actuating lines.

Note: Do not loosen any of the fittings on the actuating lines at this time.

6. Inspect the actuating lines and SVAs for leakage. Each SVA piston must be in the released position (down) and locked. Check each piston to ensure that it is fully extended.

Note: If any leakage is observed, appropriate steps must be taken to implement corrective action. However, pressure should be bled off before any action is implemented on the actuating lines.

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WARNING

The system uses high pressure. Safety goggles or glasses must be worn

All pressure must be released from the actuation lines before resett Failure to do so will cause the head of the piercing pin to protrude out exposing the O-ring. This could result in the O-ring being damaged malfunction or non-function of the system as designed. Always ensure has been released before resetting the Cam/Flag.

7. After ensuring there is no leakage, loosen the swivel fitting located at the bottom right side of the UCH Control System (see Figure 5-15). Allow the pressure to vent slowly. When the pressure is completely vented, disconnect the fitting and remove the cover.

CAUTION

To avoid accidental discharge later in the service sequence, it is important to completely disconnect the fitting outside the UCH Control System.

Figure 5-15. Fitting on Outside of UCH Control System

8. Remove the spent cartridge used for the functional test.
9. Discard the spent cartridge in an appropriate manner. Check to ensure the detection lines are set. Refer to Paragraph 5-2.2.7.1.
10. Reset the Cam/Flag and reinstall the Keeper Pin into the Cam/Flag.

Note: Ensure the microswitches are setting properly. Check the Deep Mount Microswitches to ensure the trigger pin is under the paddles of the microswitches and is pushing them up. Check the High Mount Microswitches to ensure the Cam/Flag is pushing down on the paddles.

11. Install the Safety Pin into the local manual release handle of the cover assembly. Install a tamper indicator through the Safety Pin and around the handle.

12. Reset all of the SVAs. Push the spring-loaded plunger in while pushin of each SVA.
13. Carefully remove the Valve Protection Plate from the cylinder valves a: cylinder. Secure with the bolts included. Ensure that each SVA is secu

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CAUTION

A System Nitrogen Cartridge is required for final system set up. U could cause malfunction or non-function of the system.

Note: Check the condition of the flat gasket in the valve bore. Do not use a wrench or other tool to tighten the cartridge. Hand tightening is sufficient.

Figure 5-16. Valve Body with Flat Gasket

14. When all SVAs are secured, locate the System Nitrogen Cartridge (P/N 87-120043-001). In the area provided, write the date of installation of the cartridge. Carefully install the System Nitrogen Cartridge into the valve assembly of the UCH Control System. Hand-tighten until it is snug.
15. Locate the cover of the assembly. Ensure the tamper seal remains intact in the safety pin.
16. Remove the Keeper Pin from the Cam/Flag.
17. Carefully install the cover onto the enclosure. The cover has a tongue that fits into the groove of the enclosure. Center the cover over the enclosure and fit the tongue and groove together.

CAUTION

While the cover is resting on the enclosure, moving it upward could engage the local manual release with the actuation latch, causing the UCH Control System to release. Keep the cover as centered as possible while performing this step.

18. Fasten the cover to the enclosure with the captive screws. Turn the captive screws until snug.

CAUTION

Securing the High Pressure Nitrogen Tubing onto the UCH Control System will complete the setup of the Range Guard System. System discharge could occur if the system has not been properly set.

19. Secure the High Pressure Nitrogen Tubing back onto the bottom of the UCH Control System. Ensure that the fit is properly snug to prevent leakage. Refer to Figure 5-17.

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Figure 5-17. Cylinder Mounted UCH Control System

5-2.2.7.1 Disposal of Cartridge

Following are the recommended instructions for disposal of spent cartridges.

WARNING

Never dispose of a pressurized cartridge. Cartridges must be discharged before discarding. Filled gas cartridges may be dangerous if not handled properly. Do not heat cartridges above 120°F (49°C). Pressurized cartridges that become overheated can explode, and thereby cause property damage, severe personal injury, and possibly death.

Determine if gas is present in the cartridge. All puncturable type disposable cartridges are presumed to be fully charged unless the small puncturable end (opposite of the rounded bottom) is **clearly punctured**. If the puncture is not clear, the cartridge may be weighed using a scale capable of reading in grams accurate to 0.1 g. **The weight of the cartridge shall be less than the indicated weight imprinted on the side of the cartridge by the amount of the indicated charge.**

After using one of the methods described to determine that no gas is present in the cartridge, the cartridge may be placed with normal refuse, or may be placed with steel recycling materials. All of the steel cartridges are produced from a low carbon (14) steel product. Once empty, no residue remains. Cross cutting or sectioning is not required.

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5-2.2.8 PREPARATION FOR SERVICING AND TESTING THE A+ CONTROL B

1. Disconnect the copper tubing from the SVA.

Figure 5-18. Disconnect Copper Tubing

2. Verify that the system design and installation are adequate to protect the hazard area and that the installation conforms to the instructions in this manual. Some of the items to verify are:
   a. All equipment requiring fire protection within the hazard area is protected.
   b. There have been no unauthorized alterations to the protected area or equipment, or to the wet chemical system, that render the fire suppression system ineffective or non-operational.
   c. All Cylinder Mounting Brackets are securely fastened to a wall or other structural member.
   d. All nozzles are properly aimed, secured and located within the proper distance from the protected equipment. Each nozzle should be clean and equipped with a foil seal cap.
   e. The agent distribution piping is properly sized for the number and type of nozzles required.
   f. All piping joints and pipe supports are securely fastened to prevent wet chemical leakage and hazardous movement during discharge.
   g. The pipe lengths, sizes, fittings and material are as specified in this Manual.
   h. The number, type, and placement of detectors are suitable for all hazards within the hazard area.
   i. The Remote Manual Release, if used, is located in a path of exit or egress and is clearly identified.
   j. Stainless steel control cable lengths and Corner Pulley counts are within listed limits. Conduit runs should be clean and secure.
   k. All wiring is in compliance with local codes.
   l. All field wiring is free of ground fault or short-circuit conditions.
   m. No branch circuits exist in the wiring to the detectors.
   n. All auxiliary components such as Pressure Operated Release are secure and show no evidence of physical damage.
   o. All system components and installation material are as specified in this manual.
3. Remove the A+ Control Box cover.
4. Remove the CO_2 cartridge from the A+ Control Box and dispose of it properly.

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Note: CO_2 cartridge can be used to test the system before discarding. Do
cartridge.

WARNING

**Never dispose of a pressurized cartridge. Cartridges must be
discarding. Filled gas cartridges may be dangerous if not handled pro
cartridges above 120°F (49°C). Pressurized cartridges that becom
explode, and thereby cause property damage, severe personal injury, a**

5. Remove the System Valve Actuators from all cylinders. See Figure 5-19 for location.

Figure 5-19. System Valve Actuators

6. Install cylinder valve protection plates.
7. Disconnect Discharge Adapter Kit (agent piping) from all cylinders (see Figure 5-20).

Note: Disconnecting the Discharge Adapter Kit typically involves removing cylinders.

8. Install the Anti-Recoil Plate.

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Figure 5-20. Removing Discharge Adapter Kit

5-2.2.9 ARMING THE A+ CONTROL BOX

1. Allow about 18 inches (452 mm) of cable to extend into the box for connection to the valve body lever.
2. Locate the slot in the back panel located behind the valve body lever. Place the tip of a screwdriver in the slot.
3. Pull down on the screwdriver causing the spring to stretch until the tensioning tool holes in the valve body and lever are lined up.
4. Install the Keeper Pin. The A+ Control Box is now held in the "SET" position (see Figure 5-21).

Figure 5-21. A+ Control Box in “SET” Position

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5. Locate the Cable Tension Block Assembly. With the screw threaded out or Block Assembly, thread the detection cable through the cable tension block

Note: It is necessary for you to have already cut and crimped the detection line the "S" hooks and fusible links prior to the step of removing the cable sl final adjustments.

Figure 5-22. Cable Tension Block Assembly

6. Thread the end of the detection cable through the hole in the valve body lever.
7. Thread detection cable through hole in the top of the A+ Control Box.
8. Fasten vise grips to the end of the detection cable. Pull on the detection cable and make sure to remove most of the cable slack.
9. Tighten the lever set screw onto the cable.
10. Tighten the adjustment screw on the Cable Tension Block Assembly until the tension on the cable is balanced and allows the Keeper Pin to easily slide out of the valve body. Leave the Keeper Pin in place until after the CO_2 cartridge is installed. This will prevent accidental discharge.

If the Keeper Pin does not slide out easily, not enough cable slack was removed when the cable was pulled through the valve body lever. Loosen the adjusting screw in the Cable Tension Block Assembly and then repeat steps above.

Note: It is recommended that you cut the detection cable close to the lever.

After completing the tensioning of the detection system, make sure that each detector has the required 3 inches (76 mm) minimum spacing, in the direction of cable travel, between the cable clamp or block and the end of the conduit fitting in the detector bracket.

5-2.2.9.1 Checking Microswitches

Check to ensure that the microswitches are set. Adjust the microswitch toward the lever until the paddle on the microswitch just touches the top corner of the microswitch body. The microswitch is now in the 'Set' position.

5-2.2.9.2 Checking Gas Valve

When the lever is in the 'Set' position, verify the gas valve is in the open position.

When the lever is in the 'Released' position, verify the gas valve is in the closed position.

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5-2.2.10 FUNCTIONAL TESTING OF THE A+ CONTROL BOX

Perform the Post Installation Checkout in Paragraph 4-5.

5-2.2.10.1 Test Mechanical Link Lines for the A+ Control Box (If Applicable)

To test the mechanical detector lines, perform the following steps.

CAUTION

The mechanical detector lines are under tension. Wearing safety glasses and gloves is required during this process.

Before cutting a detector, ensure the CO_2 Cartridge is not installed in the A+ Control Box and the Keeper Pin is in place in the valve body.

1. Remove the Keeper Pin from the valve body.
2. Go to the far end of the detection line. Cut the detector.
3. Check to ensure the lever has moved to the 'Discharge' position.
4. Check the microswitches to ensure that they have changed phase as intended.
5. Check the gas valve line to ensure that it has moved freely and that the gas valve has closed. Verify that all gas fired appliances have shut down, including the pilot lights.
6. Check each detector and bracket to ensure the travel distance of the cable. Make sure the line has operated without interference at any place in the system.
7. Replace detector that was cut.
8. Refer to Paragraph 5-2.2.9, "Arming the A+ Control Box".
9. Reset all electrical shut-offs.

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5-2.2.11 TEST REMOTE MANUAL RELEASE, 9197463 (IF APPLICABLE)

CAUTION

Before testing the Remote Manual Release, ensure the CO_2 installed in the A+ Control Box and remove the Keeper Pin fron

1. Operate the Remote Manual Release by removing the pull pin.
2. Go to the A+ Control Box and check to ensure the lever is in the 'Discharge' position.

5-2.2.12 TESTING MICROSWITCHES (IF APPLICABLE)

CAUTION

Before testing the microswitches, ensure the CO_2 Cartridge is not installed in the A+ Control System and that the Keeper Pin is in place in the valve body.

Note: If there are no microswitches installed in the system, proceed to Paragraph 5-2.2.12.1.

1. Remove Keeper Pin.
2. Verify actuation of the A+ Control System and the lever is in the 'Discharge' position.
3. Using a voltmeter, check the microswitches to ensure that they have changed phase as intended.
4. Check the gas valve line to ensure that it has moved freely and that the gas valve has closed. Verify that all gas fired appliances have shut down, including the pilot lights.
5. Ensure that the fire control panel has been reset according to the DIOM Manual for the fire control panel being used.
6. Check and ensure the lever is reset back to the 'Set' position.
7. Insert Keeper Pin into port on valve body.
8. Reset all electrical shut-offs.

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5-2.2.12.1 Visual Inspection of the Copper Tubing

To perform an inspection of the copper tubing, use the following steps.

1. Ensure Keeper Pin is in the valve body.
2. Ensure that all fittings are tightly attached.

CAUTION **It is important to verify that the lever is in the 'Set' position and the Keeper Pin must be in place in the valve body.**

3. Check all of the SVA pistons to ensure that they are in the set position.

   The bottom surface of the piston must be in the body of the SVA. If it is in the released position, push the piston into the body of the SVA (see Figure 5-23).

Recommendation: Badger recommends that the actuation testing take place before the full discharge test.

Figure 5-23. SVA in 'Set' Position

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5-2.2.12.2 Installing the CO_2 Gas Cartridge in the A+ Valve Body

After the gas valve connection has been made and the optional microswitch(es cartridge must be installed.

1. Carefully install the CO_2 cartridge into the valve body of the A+ Control Box it is snug.

CAUTION **If the CO_2 cartridge is not sealed against the valve gasket, or the valve gasket is missing, the system will not function properly. Verify correct installation.**

2. Remove Keeper Pin.

CAUTION **Be sure to remove the Keeper Pin. Failure to remove the Keeper Pin will result in an inoperative system.**

After initial installation, perform the actuation test described in Paragraph 5-2.2.13.

Figure 5-24. Installing CO_2 Gas Cartridge

5-2.2.13 ACTUATION TEST FOR THE A+ CONTROL BOX (IF APPLICABLE)

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CAUTION

The mechanical detector lines are under tension. Wearing safety glas during this process.

1. Remove the System Valve Actuator (SVA) from each cylinder and v copper tubing connected to the SVAs.
2. Go to the far end of the detection line. Cut the detector.
3. Check the CO_2 cartridge to ensure it has discharged.
4. Using a voltmeter, check the microswitches to ensure that they have changed phase as intended.
5. Check the gas valve line to ensure that it has moved freely and that the gas valve has closed. Verify that all gas fired appliances have shut down, including the pilot lights.
6. Check each detector and bracket to ensure the travel distance of the cable. Make sure the line has operated without interference at any place in the system.
7. Reset all electrical shut-offs.

CAUTION

This step must be done before the A+ Control Box is reset, otherwise the valve body O-ring could be damaged.

8. Carefully release residual pressure in the copper tubing line by slightly loosening a tubing nut. If there is no pressure in the line, check for leaks.
9. Retighten the tubing nut after all the residual pressure is released.
10. Reset all of the SVAs. Push the spring-loaded plunger in while pushing the piston into the body of the SVA.
11. Reset the A+ Control Box by installing the Keeper Pin as previously stated.
12. Remove and discard the used CO_2 cartridge. Refer to Paragraph 5-2.2.13.1.
13. In the area provided, write the date of installation of the cartridge.
14. Carefully install the CO_2 cartridge into the valve body of the A+ Control Box. Hand-tighten in until it is snug.

CAUTION

If the CO_2 cartridge is not sealed against the gasket or the gasket is missing, the system may not function properly.

15. Remove Keeper Pin.

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16. Secure the cover to A+ Control Box, making sure that the lever is visible i cover.

CAUTION

Be sure to remove the Keeper Pin. Failure to remove the Keeper Pi inoperative system.

Figure 5-25. A+ with Cover Installed

5-2.2.13.1 Disposal of Cartridge

Following are the recommended instructions for disposal of spent cartridges.

WARNING

Never dispose of a pressurized cartridge. Cartridges must be discharged before discarding. Filled gas cartridges may be dangerous if not handled properly. Do not heat cartridges above 120°F (49°C). Pressurized cartridges that become overheated can explode, and thereby cause property damage, severe personal injury, and possibly death.

Determine if gas is present in the cartridge. All puncturable type disposable cartridges are presumed to be fully charged unless the small puncturable end (opposite of the rounded bottom) is **clearly punctured**. If the puncture is not clear, the cartridge may be weighed using a scale capable of reading in grams accurate to 0.1 g. **The weight of the cartridge shall be less than the indicated weight imprinted on the side of the cartridge by the amount of the indicated charge.**

After using one of the methods described to determine that no gas is present in the cartridge, the cartridge may be placed with normal refuse, or may be placed with steel recycling materials. All of the steel cartridges are produced from a low carbon (14) steel product. Once empty, no residue remains. Cross cutting or sectioning is not required.

This completes the Semi-Annual Service of the Range Guard Wet Chemical System.

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5-2.3 Twelve-Year Maintenance

The 12-year maintenance is typically done in conjunction with the semi-ar procedures shall be performed **in addition** to the tests conducted a (Paragraph 5-2.2), and the monthly inspections (Paragraph 5-2.1).

Refer to NFPA 17A, NFPA 96, DOT and TC requirements for all 12-year ma testing.

5-2.3.1 WET CHEMICAL CYLINDERS

Badger recommends that a complete internal inspection be done in accordance with this schedule.

Table 5-4. Wet Chemical Cylinder Inspection

Checkbox	Procedure	Section
☐	Determine date of cylinder manufacture. See CGA pamphlet C-1 for hydrostatic test requirements.	Paragraph 5-2.3.2
☐	Depressurize the Cylinder and Valve Assembly.	Paragraph 5-2.3.3.2
☐	Remove the valve and siphon tube.	Paragraph 5-2.3.3.3
☐	Remove and discard the wet chemical from the cylinder.	Paragraph 5-2.3.3.3
☐	Visually inspect the entire inside surface of the cylinder, per CGA pamphlet C-6.	
☐	Hydrostatically test the cylinder.	Paragraph 5-2.3.2
☐	Rebuild valve with new stem/O-ring and new valve/cylinder O-ring (Cylinder Rebuild Kit P/N B120067).	Paragraph 5-2.3.3.4
☐	Recharge the cylinder.	Paragraph 5-2.3.3.5

5-2.3.2 HYDROSTATIC TESTING

Refer to Title 49 of the Code of Federal Regulations Paragraph 180, and CGA pamphlets C-1 and C-6. Refer to http://www.cganet.com for more details.

Hydrostatic testing is to be performed on the Range Guard cylinder in compliance with the appropriate DOT and TC requirements.

The wet chemical is to be discarded when performing the hydrostatic test.

Note: Do not reuse the wet chemical per NFPA-17A.

To protect the hazard during this testing period, a substitute cylinder is to be used, one equal to the unit under test. An alternate protection method may be used so long as it is acceptable to the Authority Having Jurisdiction (AHJ).

CAUTION

This is only an example; failure to properly identify and test the cylinder to appropriate DOT and TC requirements may result in damage to cylinder.

No leakage, rupture, or expansion greater than 10% shall be allowed. Internal or external corrosion, denting, bulging, or evidence of rough usage that would be likely to weaken the cylinder should cause the cylinder to be condemned and replaced.

Cylinders are to be either hydrostatically tested or volumetric-expansion tested to **TWO TIMES** the standard rating. A cylinder's standard rating is stamped on the crown or footing of the cylinder. For example:

MARKINGS:	DOT 4BW-250	TC-4BWM17.2
RATING:	250 PSI	17.2 BAR
TEST PRESSURE:	500 PSI	34.5 BAR

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When cylinders have been hydrostatically tested, recharge according to Paragrap

5-2.3.3 RECHARGE INSTRUCTIONS

5-2.3.3.1 General Information

The Karbaloy wet chemical used in extinguishing a fire is not harmful, but if the chemical comes in contact with food, it will cause the food to become unpalatable.

It is best to clean the area immediately after fire extinguishment. After the appliances have completely cooled, the residue from the discharge may be cleaned up using a wet cloth or sponge. Wear rubber gloves while cleaning. If skin or eyes come in contact with the agent, flush thoroughly with water.

The Pneumatic Release must be disassembled and cleaned of wet chemical. The Pneumatic Release's stem and piston preformed packing must be lubricated with silicone grease. In addition, the two-way check tee (if used) is to be blown clean with nitrogen to remove all wet chemical.

5-2.3.3.2 Depressurize Cylinder and Valve Assembly

Note: Before beginning, refer to Paragraph 5-2.3.3.5 for preparation before recharging.

WARNING

Protective eyewear must always be worn when working with pressurized cylinders. Never service a Cylinder and Valve Assembly unless the Anti-Recoil Plate (P/N 255681) and Protection Cap (P/N 255096) are installed.

Do not use oxygen to blow out agent distribution piping. The use of oxygen is very dangerous as the possible presence of even a minute quantity of oil may cause an explosion, thereby causing death, serious injury and/or property damage.

1. Ensure all pressure is vented by slowly loosening the High-Pressure Nitrogen Tubing at the bottom of the UCH Control System, or by loosening the copper tubing from the valve body of the A+ Control Box.
2. Check each pressure gauge to ensure that all cylinders are empty.
3. Unbolt the Discharge Adapters and the SVAs from all discharged cylinders.
4. Loosen the Mounting Bracket retaining strap(s) and install the Anti-Recoil plate(s) and the Protection Cap(s).
5. Remove all discharged cylinder(s).

Note: All cylinders shall be recharged as described Paragraph 5-2.3.3.5.

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5-2.3.3.3 Disassemble the Cylinder Valve

1. Remove the valve and siphon tube assembly from the discharged cylin
2. Invert the cylinder and tap the threaded neck end on a wooden block t chemical.
3. Blow any wet chemical residual from the valve, siphon tube and cylinc
4. Visually inspect the entire inside and outside surface of the cylinder p

5-2.3.3.4 Rebuilding Cylinder Valve

When rebuilding the cylinder valve, use the Cylinder Rebuild Kit, P/N B120067. This kit includes:

- Valve stem,
- Valve spring,
- Spring retainer,
- Cylinder O-ring,
- Retaining ring, and
- Valve stem O-ring.

Use the following procedures to rebuild the cylinder valve.

1. Remove siphon tube from the cylinder valve.
2. Secure valve body. Place valve body over a short piece of 3/4-inch pipe (or equivalent) to prevent the valve stem from falling out.
3. Remove the following from the valve body:
   - Retaining ring
   - Spring retainer
   - Valve spring
   - Valve stem
   - Cylinder valve O-ring

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Figure 5-26. Valve Assembly

4. Put a light coating of lubricant (supplied in the Valve Rebuild Kit) on the valve stem O-ring. Do not grease the bonded seal on valve check (see Figure 5-26).
5. Install the valve stem.
6. Install valve spring.
7. Install spring retainer.
8. Push down on the valve spring and spring retainer. Install the retaining ring.
9. When installing the retaining ring, it is recommended that you use a box wrench to push the valve spring down and to maintain pressure while encompassing the retaining ring in place.
10. Put a light coating of lubricant (supplied in the Valve Rebuild Kit) on the cylinder valve O-ring.
11. Install valve to cylinder O-ring.
12. Reinstall siphon tube to cylinder valve.

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5-2.3.3.5 Recharging Cylinders

WARNING

Under no circumstances while performing cylinder recharge shou allowed to "free stand" without either the charging apparatus at plate installed. Whenever these devices are not installed, a ch securely clamped to a rigid structure capable of withstanding tl result should the valve inadvertently open. Refer to the Saf information regarding pressurized cylinders.

CAUTION

Do not attempt to recharge any cylinder without first checking for last hydrostatic test date. The U.S. Department of Transportation (DOT) and Transport Canada (TC) has ruled that any pressurized container of the type used in wet chemical systems shall not be recharged or transported with out first being inspected internally and externally and hydrostatically tested if more than twelve years have elapsed since the date of the last hydrostatic test. Regardless of previous inspection dates, it is illegal to refill any pressurized container that leaks, which bulges, has defective safety devices, bears evidence of physical abuse, fire or heat damage, or detrimental rusting or corrosion, until it is properly repaired and requalified as specified in DOT and TC regulations.

1. Fill the cylinder with the appropriate weight of the Karbaloy agent as indicated on the cylinder nameplate. Use the following Badger P/Ns:

Cylinder Model	Recharge Container P/N
RG-1.25G	87-120030-001
RG-2.5G	87-120031-001
RG-4GS	87-120032-001
RG-4GM	87-120032-001
RG-6G	87-120033-001

2. Reinstall the siphon tube and valve and ensure it is tight.
3. Unbolt the Anti-Recoil Plate and bolt the charging adapter to the outlet port of the valve. Securely clamp the cylinder to a rigid structure.
4. Use dry nitrogen to pressurize the cylinder to 175 PSI (12.1 bar) at 70°F (21°C). Use a calibrated gauge.

Note: Do not rely on the pressure regulator or the cylinder pressure gauge to determine the container pressure (see Figure 5-32 for a suggested recharging arrangement).

5. Remove the charging adapter and check for leakage using a soap solution.
6. Bolt the Anti-Recoil Plate to the valve outlet. Leave the protection plates in place until the cylinder is ready to be reinstalled.

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Figure 5-27. Recharge Hookup

After the inspections and procedures described previously in this section, and after having recharged all wet chemical cylinders, the fire suppression system is ready to be fully checked out before installation of the recharged wet chemical cylinders. Perform the steps outlined in Paragraph 5-2.2.6, Functional Testing of the System.

5-2.3.3.6 Cylinder Leak Test

1. Remove the spare discharge adapter and check for leakage using a soap solution.
2. Bolt the anti-recoil plate, P/N 255681, to the valve outlet. Leave the protection plates in place until the cylinder is ready to be reinstalled.

5-2.3.4 UCH CONTROL SYSTEM COMPONENT MAINTENANCE

The System Nitrogen Cartridge (P/N 87-120043-001) requires replacement at intervals of twelve years. Check the date that was written on the cartridge at the time of installation.

At the time of replacement, the old System Nitrogen Cartridge may be used for the functional tests.

5-2.3.4.1 Rebuild the UCH Control System Valve

The UCH Pin/Gasket Rebuild Kit (P/N B120046) includes the following:

- Valve Gasket
- Piercing Pin
- O-ring
- Retaining Ring
- Pin/Gasket Service Label

Refer to Figure 5-28 when performing the service operation.

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Figure 5-28. Valve Body with Piercing Pin Shown

1. Ensure that the Cam/Flag is in the Released position.
2. Remove the System Nitrogen Cartridge.
3. Carefully remove the retaining ring. Refer to Figure 5-28 for location.
4. Slide the Cam/Flag off the shaft.

CAUTION

The point on the piercing pin is extremely sharp. Handle with care. It is important to discard the piercing pin that is removed from the UCH Control System at the 12-year cycle. It must never be used again.

5. Using a small screwdriver or other tool, push the Piercing Pin (P/N 9197212) out of the port, in the direction of the shaft. Discard the Piercing Pin.
6. Remove and discard the Flat Gasket (P/N 236204) located inside the gas cartridge inlet.

CAUTION

Use care not to damage the threads in the gas cartridge inlet.

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Figure 5-29. Removal of Piercing Pin and Flat Gasket

7. Insert a new Flat Gasket (Use only P/N 236204). Ensure that the gasket is seated firmly inside the gas cartridge inlet.
8. With the sharp end of the Piercing Pin pointed into the port, push the Piercing Pin into the port until the O-ring is inside the valve body.
9. Reinstall Cam/Flag.

Note: Ensure there is no interference with the Piercing Pin. If there is interference, push the pin further into the body. While sliding the Cam/Flag over the shaft, ensure that the paddles for the microswitches also do not interfere.

10. Install the new retaining ring into the groove on the top of the shaft.

Note: The Cam/Flag may seem slightly loose on the shaft. It will turn slightly This is acceptable. There will be further tests to ensure the fit is proper.

11. Turn the Cam/Flag to check engagement with the microswitch paddles.
12. Write the date on the Pin/Gasket Service Date label in the space provided. Attach the Pin/Gasket Service Date label.

Note: Do not install the label onto the local manual release handle. Attach it to another part of the system where is will not interfere with system operation.

CAUTION

Only System Nitrogen Cartridge shall be used for final system set up. Using any other cartridge could cause malfunction or non-function of the system in an emergency situation.

13. Once these steps have been performed, proceed with all Functio according to Paragraph 5-2.2.7. At the completion of the Actuation T Nitrogen Cartridge. In the space provided, write in the date the ca Carefully install the System Nitrogen Cartridge into the valve asser System. Hand tighten until it is snug.

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Note: Do not use a wrench or other tool to tighten the cartridge. Hand leakage is observed, check the condition of the cam and flat gaske bore.

14. Review system operation with the owner or other responsible persons.
15. Dispose of cartridge according to the instructions in Paragraph 5-2.2.7.1.

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5-3 POST-DISCHARGE MAINTENANCE

5-3.1 General Information

The Karbaloy wet chemical used in extinguishing a fire is not harmful. However, i area immediately after fire extinguishment. Prolonged exposure of equipment t result in localized corrosion due to moisture in the air.

The pneumatic release must be disassembled and cleaned of wet chemical. The pneumatic release's stem and piston preformed packing must be lubricated with silicone grease. In addition, the two-way check tee (if used) is to be blown clean with dry nitrogen to remove all wet chemical.

5-3.2 Appliance Cleanup

No unusual cleanup procedure is required. The reaction of the wet agent and the grease is one of saponification and it produces a foam which can be wiped off. After the appliances have completely cooled, the residue from the discharge may be cleaned up using a wet cloth or sponge. Wear rubber gloves and eye protection while cleaning. If skin or eyes come in contact with the agent, flush thoroughly with water.

WARNING

Do not disturb the foam until the cooking appliances, plenum, and duct have cooled sufficiently. Do not put water on hot grease as this will cause violent steaming and spattering.

WARNING

Karbaloy wet agent is electrically conductive. To avoid electrical shock, de-energize all electric circuits to appliances, outlets, and wiring by disconnecting or turning off the electric power at the main fuse or circuit breaker box. Do not cleanup Karbaloy wet agent or touch electric appliances, outlets, power cords, or other wiring with electric power on.

5-3.3 Cylinder and Valve Assembly

Check each pressure gauge to ensure that all cylinders are empty. Unbolt the discharge adapters and SVA(s) from all discharged cylinders. Loosen the mounting bracket retaining straps and install the anti-recoil plates and the shipping caps. Remove all discharged cylinders. Bolt a test fixture to each SVA.

All cylinders shall be recharged as described in Paragraph 5-2.3.3.5, Recharging Cylinders

5-3.3.1 VALVE DISASSEMBLY - See Paragraph 5-2.3.3.3, Disassemble the Cylinder Valve

WARNING

Protective eyewear must always be worn when working with pressurized cylinders. Never service a cylinder-and-valve assembly unless the Anti-Recoil Plate (P/N 255681) and Shipping Cap (P/N 255096) are installed.

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5-3.4 Resetting the Mechanical System

1. Replace all detectors with new detectors having the same temperatu original detectors.

Note: Any detectors exposed to heat will no longer provide reliable protect

2. After replacing the detectors, remove the front cover from the UCH Con Box. Reset the UCH Control System or A+ Control Box as described i

5-3.5 Resetting the Electrical System

1. Inspect and test all thermostats. Replace any thermostats that have obviously been damaged by exposure to excessive heat. Check the actuation set point of the remaining thermostats by heating the thermostats and recording the actuation temperature. If the actuation temperature of any thermostat is more than 10° F higher than its original setting, the thermostat should be replaced. Hot oil and a high-temperature thermometer can be used to check the temperature. Heating should be done slowly.
2. After replacing any damaged thermostats, remove the front cover from the UCH Control System or A+ Control Box. Reset the UCH Control System or A+ Control Box as described in Chapter 4.

5-3.6 Clean Distribution System and Nozzles

1. Remove all nozzles from the system and inspect each nozzle filter for debris. Remove any debris. Clean nozzle filter under running water to remove foreign matter that might impede flow through the nozzle. Also, run water through the nozzle tip to insure the orifice is not clogged. Thoroughly dry nozzles with dry air or nitrogen and reassemble.

Note: When LPR nozzle is disassembled for inspection or cleaning, reassemble with the disc/core unit with center core "nub" facing upstream. Flat side should be facing towards threaded nozzle cap.

Figure 5-30. LPR Nozzle Assembly

2. Before attaching nozzles, flush out the system with warm water as suggested in Paragraph 5-3.7. Re-install the nozzles on the distribution pipe and replace all nozzle foil seal caps.
3. Inspect the system piping and fittings and replace any pipe or fittings subjected to direct flame or excessive heating.
4. Blow out the distribution pipe with dry air or nitrogen. One possible procedure for accomplishing this is to use a test cylinder-and-valve assembly, without any wet chemical, pressurized with nitrogen to 100 psig.

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5. Verify with suitable discharge indicators that proper flow through all nozzles
6. Remove all nozzles from the system and inspect for debris. Remove any deb
7. Re-install the nozzles on the distribution pipe and replace all nozzle disc cap

WARNING **Do not use oxygen to blow out piping. The use of oxygen is very danger presence of even a minute quantity of oil may cause an explosion.**

5-3.7 Flushing Procedure

Each Badger system must have all discharge piping (or discharge tubing) flushed out with water after each discharge (see Figure 5-31). A procedure for flushing is given below:

1. Remove nozzles, disassemble and remove strainer screen only. Flush nozzle parts and strainer thoroughly with fresh water and reassemble nozzle(s).
2. Disconnect cylinder(s) and install inlet flushing adapter (9197086). Connect one end of a garden hose to water tap and the other end to inlet flushing adapter. An alternate source of water is to use a cylinder of the same size as installed in the system filled with water and pressurized to 175 psig (1205 kPa).
3. Attach outlet flushing adapter to each nozzle position.
4. Attach garden hose to each adapter.
5. Place discharge end of each hose in sink, bucket, or other point of disposal, or collect water in a properly attached bag or bucket.
6. Turn on fresh water and flush thoroughly, or discharge manually with water-filled cylinder.
7. Blow air through discharge piping to remove all excess water.
8. Install cleaned nozzles in their proper positions with a new foil seal on each.
9. Install charged cylinder(s).

Figure 5-31. Diagram for Flushing the Badger System

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5-3.8 Recharge Cylinders - See Paragraph 5-2.3.3.5, Recharging Cylinders

CAUTION

Do not attempt to recharge any cylinder without first checking date. The U.S. Department of Transportation (DOT) and Transpo that any pressurized container of the type used in Wet Chemi recharged or transported with out first being inspected intern hydrostatically tested if more than twelve years have elapsed s hydrostatic test. Regardless of previous inspection dates, it is illegal to refill any pressurized container that leaks, which bulges, has defective safety devices, bears evidence of physical abuse, fire or heat damage, or detrimental rusting or corrosion, until it is properly repaired and requalified as specified in DOT and TC regulations.

5-3.9 Cylinder and Valve Reassembly

1. Replace the Valve-to-Cylinder O-Ring, P/N 5661-0327.
2. Fill the cylinder with the appropriate weight of the Karbaloy agent as indicated on the cylinder nameplate. Use the following Badger P/Ns:

Cylinder Model	Recharge Container P/N
RG-1.25G	87-120030-001
RG-2.5G	87-120031-001
RG-4GS	87-120032-001
RG-4GM	87-120032-001
RG-6G	87-120033-001

3. Reinstall the siphon tube and valve and ensure it is tight.
4. Install O-Ring (P/N 1080-1900) on a spare discharge adapter (P/N 83-844908-000).
5. Unbolt the anti-recoil plate and bolt the spare discharge adapter to the outlet port of the valve. Securely clamp the cylinder to a rigid structure.

WARNING

Under no circumstances while performing cylinder recharge should a charged cylinder be allowed to "free stand" without either the charging apparatus attached or the anti-recoil plate installed. Whenever these devices are not installed, a charged cylinder must be securely clamped to a rigid structure capable of withstanding the full thrust that would result should the valve inadvertently open.

6. Use nitrogen to pressurize the cylinder to 175 PSI (12.1 bar) at 70°F (21°C). Use a calibrated gauge.

Note: Do not rely on the pressure regulator or the cylinder pressure gauge to determine the container pressure. Refer to Figure 5-32 for a suggested recharging arrangement.

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5-3.10 Cylinder Leak Test

1. Remove the spare discharge adapter and check for leakage using a soap solu
2. Bolt the anti-recoil plate, P/N 255681, to the valve outlet. Leave the protection the cylinder is ready to be reinstalled.

Figure 5-32. Recharge Hookup

5-3.11 Rechecking the System

After the inspections and procedures described previously in this section, and after having recharged all wet chemical cylinders, the fire-suppression system is ready to be fully checked out before installation of the recharged wet chemical cylinders.

1. Follow the system checkout and test procedures outlined in Chapter 4. Follow the procedures for UCH Control System or A+ Control Box mechanical and/or electrical devices as appropriate.
2. Be sure to check the system for all three modes of operation (automatic, local-manual, and remote-manual actuation).
3. After the system has been satisfactorily checked out, follow the-steps under Paragraph 4-6 “Commissioning the System.”
4. After completing the “Commissioning the System” procedure, the system will be online and ready to protect the process, equipment, or combustibles. As with any equipment, periodic maintenance must be performed as indicated in Table 5-1.

CHAPTER 6
PARTS LIST

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Table 6-1. Parts List

WET CHEMICAL CYLINDER AND VALVE ASSEMBLIES	
RG-1.25G Cylinder and Valve Assembly with 1.25 Gal. of Wet Agent	60-120001-001
RG-2.5G Cylinder and Valve Assembly with 2.6 Gal. of Wet Agent	60-120002-001
RG-4GS Cylinder and Valve Assembly with 4 Gal. of Wet Agent	60-120003-001
RG-4GM Cylinder and Valve Assembly with 4 Gal. of Wet Agent	60-120006-001
RG-6G Cylinder and Valve Assembly with 6 Gal. of Wet Agent	60-120005-001
Discharge Adapter Kit (one required for each Range Guard cylinder)	83-844908-000
Vent Plug (units of 1) — One must be used in each set of piping	9196984
Gauge Shield	131024
CYLINDER MOUNTING EQUIPMENT	
RG-1.25G Mounting Bracket	9197430
RG-2.5G Mounting Bracket	9197263
RG-4GS Mounting Bracket	9197415
RG-4GM Mounting Bracket	9197414
RG-6G and RG-4GM Shelf Bracket	100013
Badger CONTROL SYSTEM	
UCH Control System Includes: (1) B120042 SVA (1) 87-120043-001 System Cartridge (1) 87-120044-001 Test Cartridge (1) B120058 EMT Connector Kit (2) B120039 Microswitch Kit	B120099
High Pressure Hose (required for cylinder mounted Control System)	B120045
System Valve Actuator (SVA)	B120042
Solenoid, 24 VDC for P/N B120099	B100034
Microswitch Kit, SPDT, for P/N B120099	B120039
Microswitch Kit, SPDT, Alarm/Release for P/N B120099	B140047
EMT Connector and O-Ring Kit, 3 sets	B120058
A+ Control Box Assembly Includes: (1) B120042 System Valve Actuator (2) set screws (1) Grommet (1) 231865 Label (1) 231865 Caution Label	B120010
Single SPDT Microswitch Kit for A+	9197227
Dual SPDT Microswitch Kit for A+	9197228
SPDT Pressure Operated Switch	9197023

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Table 6-1. Parts List (Continued)

DISCHARGE NOZZLES and ACCESSORIES	
ADP Nozzle (package of 10 of 87-120011-001)	87
F Nozzle (package of 10 of 87-120012-001)	87
GRW Nozzle (package of 10 of 87-120013-001)	87
LPF Nozzle (package of 10 of 87-120022-001)	87
R Nozzle (package of 10 of 87-120014-001)	87-120019-001
LPR Nozzle (package of 10 of 87-120024-001)	87-120025-001
DM Nozzle (package of 10 of 87-120015-001)	87-120020-001
All nozzles are 3/8 in. NPT Female	
3/8 in. Swivel Adapter for Nozzles (each)	87-120021-001
Replacement Nozzle Seals (10 pack)	9197054
Disc Cap (10 pack) — not for LPR	9197290
Disc Cap (each) — for LPR ONLY	120026
MECHANICAL ACTUATION COMPONENTS	
Note: Fusible Links and Thermo-bulb Links are non-returnable	
Universal Link Housing Includes: (1) Bracket (11-3/4 in.) (2) Cable Crimp Sleeve (2) “S” Hook	120064
Link Housing Kit (not to be used with A+) Includes: (1) 279403 Bracket (1) 216209 “S” Hook (2) 54240800 1/2 in. EMT Connector (4) 214951 Cable Crimp Sleeve	804548
BTBS-165 Standard Response Link, 165°F (74°C), Red (Package of 5)	87-120091-165
BTBS-212 Standard Response Link, 212°F (100°C), Green (Package of 5)	87-120091-212
BTBS-286 Standard Response Link, 286°F (141°C), Blue (Package of 5)	87-120091-286
BTBS-360 Standard Response Link, 360°F (182°C), Mauve (Package of 5)	87-120091-360
BTBS-450 Standard Response Link, 450°F (232°C), Black (Package of 5)	87-120091-450
BTBS-500 Standard Response Link, 500°F (260°C), Black (Package of 5)	87-120091-500
BTBR-165 Rapid Response Link, 165°F (74°C), Red (Package of 5)	87-120096-165
BTBR-212 Rapid Response Link, 212°F (100°C), Green (Package of 5)	87-120096-212
BTBR-286 Rapid Response Link, 286°F (141°C), Blue (Package of 5)	87-120096-286
BTBR-360 Rapid Response Link, 360°F (182°C), Mauve (Package of 5)	87-120096-360
BTBR-450 Rapid Response Link, 450°F (232°C), Black (Package of 5)	87-120096-450
BTBR-500 Rapid Response Link, 500°F (260°C), Black (Package of 5)	87-120096-500
DETECTION AND ACTUATION ACCESSORIES	
Mechanical Remote Manual Release (Cable)	B875572
Corner Pulley	B844648
DETECTION AND ACTUATION ACCESSORIES (continued)	
Tee Pulley	843791

Table 6-1. Parts List (Continued)

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Cable, 1/16 in. x 500 ft. long	
EMT Adapter, 1/2 in. EMT x 3/8 in. NPT	
Crimp Sleeve (package of 50 Pieces of 214951)	
"S" Hook (package of 50 pieces 9189413)	
Pressure Operated Switch, 3 Pole (use on UCH only)	
Type A Fusible Links (*not to be used with Badger Mechanical Control Head)*	
RG-360 "A" Link, 360°F (182°C)	87-120060-001
A+ / UCH Inline Remote Manual Release, Surface Mount	100030
A+ / UCH Inline Remote Manual Release, Recessed Mount	9197460
A+ / UCH EOL Remote Manual Release, Surface Mount	9197463
A+ / UCH EOL Remote Manual Release, Recessed Mount	9197461
3-Way Pulley for In-line Release ONLY (10 pack)	9197286
Type ML Fusible Link	
ML-165 Link 165°F (74°C) "ML" Yellow	WK-282661-000
ML-212 Link 212°F (100°C) "ML" White	WK-282662-000
ML-360 Link 360°F (182°C) "ML" Unpainted	WK-282664-000
ML-500 Link 500°F (260°C) "ML" Orange	WK-282666-000
MECHANICAL CABLE OPERATED GAS SHUTOFF VALVES	
3/4 in. NPT	B120071
1 in. NPT	B120072
1-1/4 in. NPT	B120073
1-1/2 in. NPT	B120074
2 in. NPT	B120075
2-1/2 in. NPT	B120076
3 in. NPT	B120077
Pneumatic Release	9189412

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Table 6-1. Parts List (Continued)

ELECTRIC SOLENOID GAS SHUTOFF VALVES	
1/2 in. NPT Electric Solenoid Gas Shutoff Valve	
3/4 in. NPT Electric Solenoid Gas Shutoff Valve	
1 in. NPT Electric Solenoid Gas Shutoff Valve	
1-1/4 in. NPT Electric Solenoid Gas Shutoff Valve	
1-1/2 in. NPT Electric Solenoid Gas Shutoff Valve	9197021
2 in. NPT Electric Solenoid Gas Shutoff Valve	9197022
2-1/2 in. NPT Electric Solenoid Gas Shutoff Valve	9197444
3 in. NPT Electric Solenoid Gas Shutoff Valve	9197445
Manual Reset Relay (Required)	9101735
BMCS1 AND BMCS7 PRESSURE OPERATED RELEASING SYSTEM	
BMCS-100 Nitrogen Cylinder	100004
BMCS-100 Actuator Assembly	100010
BMCS-100 Mounting Bracket	100011
System Valve Actuator	B120042
Pressure Operated Actuator	100012
BMCS-100 Nitrogen Cylinder	486676
Mounting Bracket	486487
BMCS-700S Discharge Adapter Kit	844921
Check Valve	259404
Vent Check	877810
Replacement Receiver Gasket (for BMCS-100 Actuator Assembly)	263413
QUIK-SEAL™ AND COMPRESSION SEAL ADAPTERS	
Compression Seal Adapter — 3/8 in. Tubing	26504601
Compression Seal Adapter — 1/2 in. Tubing / 1/4 in. Pipe	26504602
Compression Seal Adapter — 5/8 in. Tubing / 3/8 in. Pipe	26504603
Compression Seal Adapter — 3/4 in. Tubing / 1/2 in. Pipe	26504605
Compression Seal Adapter — 1/2 in. EMT	26504604
QUIK-SEAL™ ADAPTERS	
Quik-Seal Adapter — 3/8 in. NPT Female	26499301
Quik-Seal Adapter — 1/2 in. NPT Female	26499302
Quik-Seal Adapter — 3/4 in. NPT Female	26499303
Quik-Seal Adapter — 1 in. NPT Female	26499304
Quik-Patch™ (for Hole Patching up to 1-1/8 in. Diameter)	26499305
ELECTRIC COMPONENTS	
Circuit Monitor 12 Vdc	844533
Circuit Monitor 24 Vdc	844534
Circuit Monitor 120 Vdc	844535
VALVE SPARE PARTS	
Valve Assembly	B120009

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Table 6-1. Parts List (Continued)

VALVE SPARE PARTS (continued)	
Replacement Gauge	
Valve Rebuild Kit, includes (1) 877343 Valve Stem with 64350006 O-Ring attached (1) 217768 Valve Spring (1) 253299 Valve Spring Retainer (1) 18490004 Retaining Ring Check (1) 56610327 O-Ring, Valve to Cylinder	
Fusible Plug	257754
Valve Outlet Anti-Recoil Plate	255681
Protection Plate (for Valve Top)	255096
SYSTEM SPARE PARTS	
In-line Kit for Remote Manual Release P/N 9197463	B100030
Valve Body Assembly, A+	9197210
Cable Tensioning Block, A+	9197220
O-Ring, Puncture Stem, A+	1419239
Flat Gasket, Valve Body, A+	9197213
Check Valve for Pneumatic Actuator P/N 87-100012-001	118146
Strap for RG-1.25G and RG-2.5G Brackets	255700
Strap for RG-4GS, RG-4GM, and RG-6G Shelf Bracket	117989
Seal Wire	15262
Fan Caution Decal	282726
Decal (for P/N B875572 Manual Release)	261154
Backplate (for P/N B875572 Manual Release)	277088
O-Ring (for Discharge Adapter Kit) - Minimum 10 pieces	108019000
Fuse (for P/N B899175 Electric Control Heads)	64490024
Replacement Cable Block and Set Screw Assembly for Gas Valves	100014
INSTALLATION TOOLS AND RECHARGE EQUIPMENT	
Nitrogen Cartridge for Badger UCH Control System	87-120043-001
Test Cartridge for Badger UCH Control System	87-120044-001
Keeper Pin (UCH Control System and A+)	9197108
UCH Valve Rebuild Kit	B120046
CO_2 Cartridge for A+	06-235557-001
Positive Action Crimp Tool	253538
Badger Mechanical Control Head Test Fixture	281578
Tensioning Tool, Badger Mechanical Control Head	255003
Recharge Adapter	279262
Hydrostatic Test Adapter	878453
Replacement Label for RG-1.25G	231866

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Table 6-1. Parts List (Continued)

INSTALLATION TOOLS AND RECHARGE EQUIPMENT (continued)	
Replacement Label for RG-2.5G	06
Replacement Label for RG-4GS	06
Replacement Label for RG-4GM	06
Replacement Label for RG-6G	06
Inlet Flushing Adapter, RG	60-9197086-000
Outlet Flushing Adapter, 3/8 in. RG	60-9197090-000
Outlet Flushing Adapter, 1/2 in. RG	60-9197091-000
1.25 Gallon Karbaloy® Wet Chemical Recharge Container	87-120030-001
2.60 Gallon Karbaloy® Wet Chemical Recharge Container	87-120031-001
4.0 Gallon Karbaloy® Wet Chemical Recharge Container	87-120032-001
6.0 Gallon Karbaloy® Wet Chemical Recharge Container	87-120033-001
MANUALS	
Wet Chemical System Instruction Manual (Karbaloy)	60-9127100-000
Wet Chemical System Owner's Manual (Karbaloy)	B120040

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APPENDIX A
ELECTRICAL DETECTION INSTALLA
(DETECT-A-FIRE®)

A-1 INTRODUCTION

DETECT-A-FIRE® thermal detectors are UL and ULC Listed (available upon request), and FM Approved detection and release devices used with fire detection systems to activate alarms and actuate extinguishing systems. This Rate Compensated device combines the best features of both fixed temperature and rate-of-rise detectors.

Table A-1. Electrical Rating

Model Number	Contact Operation on Temperature Rise	Electrical Rating[1] (Resistive Only)
27120	Opens (450° F Max.)	5.0 Amps 125 Vac 0.5 Amps 125 Vdc
28020		
27121	Closes	5.0 Amps 125 Vac 0.5 Amps 125 Vdc 2.0 Amps 24 Vdc 1.0 Amps 48 Vdc
28021		

[1] Although incandescent lamps are considered resistive, their inrush current is 10 - 15 times their steady current. Do not exceed ratings.

A-2 LOCATION

DETECT-A-FIRE® Units are precision temperature sensors. They must be mounted in an area (normally a ceiling) so that:

1. The detector spacing complies with both system requirements and requirements of the local Agency Having Jurisdiction.
2. The thermal air path to the shell is not obstructed.

Spacing per UL, ULC, and FM is shown in Table A-2. Distances given are for between units on smooth ceilings. Distances from partitions or walls are half that shown. To assure that all spacing requirements are met, consult the local Authority Having Jurisdiction.

A-3 MOUNTING

Detect-A-Fire units are not position sensitive. Horizontal and vertical detectors refer to the most common mounting configuration for that unit. However, each type can be mounted either horizontally or vertically depending on the application and installation requirements.

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Table A-2. Detect-A-Fire Spacing

Setting	Tolerance	SPACINGS (in feet)			
		UL	ULC	FM	
140°F	±7/-8°F	50	50	25	Black
160°F	±7/-8°F	25	25	25	Black
190°F	±7/-8°F	50	50	25	White
210°F	±7/-8°F	25	50	25	White
225°F	±7/-8°F	25	50	25	White
275°F	±10°F	25	50	25	Blue
325°F	±10°F	50	50	25	Red
360°F	±10°F	25	50	25	Red
450°F	±15°F	25	50	25	Green
500°F	±15°F	50	50	25	Orange
600°F	±20°F	N/A	50	25	Orange
725°F	±25°F	N/A	50	25	Orange

Note: For clean agents and CO_2 suppression systems, ceiling spacing 20 ft. (6.1 m) apart unless otherwise specified.

Not all units are suitable for all hazard location applications. Refer to Table A-3 and markings on the detector for hazardous location suitability.

Table A-3. Hazardous Location Applications

Hazardous Location	Model Number	Fittings Required for UL and ULC Listings and FM Approval
Class I[2], Groups A, B, C, and D; Class II[2], Groups, E, F, and G	27120-22 27121-20 28020-3 28020-5	Mount detector to a suitably-listed fitting in accordance with National Electric Code and/or Local Authority having Jurisdiction.
Class I[2], Groups B, C, and D; Class II[2], Groups, E, F, and G	27120-0 27121-0 28021-0	

[2] Division 1 and 2.

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A-4 INSTALLATION

Heat detectors are to be installed in an anticipated path of convective he spaced at a maximum on-center distance of 20 ft. (6.1 m) for ceiling height to Chapter 3).

The electrical wire from the UCH Control System or the A+ Control Box be protected by 1/2-inch EMT (minimum).

WARNING

It is likely that industrial applications involving flammable or combustible liquids will be enclosed within or surrounded by areas that will be classified as Class-I or Class-II, Division-1 or Division-2 locations (Zone 1 or Zone 2). Wet Chemical system electrical components, such as heat detectors, located within these areas shall be rated for use in classified areas, and all wiring to these components shall conform to the provisions of NFPA 70, National Electrical Code, for Class-I or Class-II, Division-1 or Division-2 locations (Zone 1 or Zone 2). Failure to follow these instructions could result in death or serious personal injury and/or property damage.

When the Heat Detector locations have been selected, mount the units as specified in the following sections.

A-4.1 Ceiling Locations

1. It is recommended that standard 4-inch octagonal outlet boxes be used to mount detectors. Use explosion-proof conduit boxes, if necessary.
2. Attach detector to the 4-inch. round outlet box cover through the 7/8-inch diameter hole using 1/2-14 NPT retainer nut. The heat detector maximum torque values are:
   - 20 foot-pounds
   - 27.1 Newton-meters
3. Connect system wiring to detector, observing spacing requirements and applicable electrical codes.
4. Apply RTV sealing compound around the end of the heat detector to which the wires are attached.
5. If moisture is present, you must use a moisture proof box. Mount detector and box cover to box using #8-32 screws.

Series 28000 units are similar to Series 27100 units except they have two 1/2-14 NPT threads for mounting.

The unit may be mounted as described above or may be threaded into a 1/2-14 NPT tapped hole in the vessel wall or threaded into a coupling brazed or welded to the vessel wall.

Note: Wire the Heat Detectors to the listed fire control panel as indicated in an approved wiring diagram.

A-4.1.1 ORDINARY LOCATIONS

The DETECT-A-FIRE Units are to be installed in grounded metallic junction boxes only. They are to be secured to the boxes using two lock nuts, one on either side of the mounting plate. DETECT-A-FIRE Units are not to be installed in non-metallic junction boxes.

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A-4.1.2 HAZARDOUS LOCATIONS

For Class I, Division 1 and 2 locations, install the DETECT-A-FIRE Unit in a lis enclosure with a minimum thread engagement of five full turns. No non-conduct placed on the threaded joint of the DETECT-A-FIRE Unit or in the listed explosi For Division 2 locations, assure that a protective ground terminal is provided in 1 proof enclosure when flexible metal conduit is used.

Figure A-1. Mounting a Detect-A-Fire

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A-4.1.3 NON-HAZARDOUS OUTDOOR LOCATIONS

Mount the DETECT-A-FIRE in a listed NEMA Type 3 outlet box, cover and threads and a minimum thread engagement of five full turns. Use of pip rubber sealant, a rubber gasket, and self-sealing screws to attach the cov tape on the DETECT-A-FIRE threads should be appropriate for outc accordance with the National Electric Code and/or Authority Having Juris

Table A-4. Non-Hazardous Outdoor Locations

Model Number	°F Temperature Settings	Fittings Required for UL Listings and FM Approval
27120-0 27120-22 27121-0 27121-20	140, 160, 190, 225	Mount detector to a fitting suitable for outside use (NEMA Type 3), in accordance with National Electric Code and/or Authority Having Jurisdiction.

A-4.2 Duct Applications

1. Drill a 1-1/4-inch (32 mm) hole at each selected location.
2. It is recommended that standard 4-inch octagonal outlet boxes be used to mount detectors. Use explosion-proof conduit boxes, if necessary. Mount the conduit box securely to the outside of the duct so that the heat detector tube extends into the duct.
3. Attach the detector to the 4-inch round outlet box cover through the 7/8-inch diameter hole using 1/2-14 NPT retainer nut.
4. Connect the system wiring to the detector, observing spacing requirements and applicable electrical codes.
5. If moisture is present, you must use a moisture proof box. Apply RTV sealing compound around the end of the heat detector to which the wires are attached.
6. Mount the detector and box cover to the box using #8-32 screws.
7. Wire the Heat Detectors to the Listed fire control panel as indicated in an approved wiring diagram.

Note: All electric fittings inside of the protected area (work area, plenum/pit/tunnel and exhaust duct) shall be Class I or II, Division I or II (Zone 1 or 2) rated electrical boxes, pipe and fittings.

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A-4.3 Field Wiring Requirement

Field wiring must be capable of withstanding the maximum anticipated ambient
application.

27121, 28021 SERIES
(NORMALLY OPEN)

TYPICAL FIRE ALARM SYSTEM METHOD

27120, 28020 SERIES
(NORMALLY CLOSED)

TYPICAL SECURITY SYSTEM METHOD

Figure A-2. System Wiring

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A-5 FUNCTIONAL TEST

When used with automatic fire extinguishing systems first disconnect th from the panel and connect a 24 Vdc bulb to initiator terminals in the contr A-FIRE units with a heat lamp or other convenient source. When the bulb i state, remove heat source and allow DETECT-A-FIRE unit to cool. Reset co change state and stay changed after system is reset. Do not reconnect initia DETECT-A-FIRE units have cooled below set point as indicated by test lam units are used in other types of systems, disconnect them from the system, connect a 24 Vdc lamp and power source in series with the DETECT-A-FIRE units and test with heat source as above. Make sure that contacts have reset to normal condition before reconnecting to system circuit.

CAUTION

1. In order to function properly, the sensing shell of the unit must remain free from paint, grease, oil, etc. Should such a build up occur, do not, under any circumstances, attempt to remove it. Replace the unit.

2. Detectors mounted in an area subject to physical abuse or damage, other than above, must be suitably protected without obstructing the thermal air path to the unit.

3. Do not install the unit where the shell would be physically damaged by sand, grain, rocks, etc.

4. Do not overtorque the unit when installing.

5. Any detector that has been abused or damaged must be replaced.

6. Consult the factory for special precautions necessary for outdoor use or moist environments.

It is possible for a unit to have been abused or damaged and not display any outward indication of the damage. All units should be tested periodically in accordance with National Fire Protection Association requirements (72) or the local Agency Having Jurisdiction.

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A UTC Fire & Security Company

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Charlottesville, VA 22901
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Fax: (800) 248-7809

Kidde Canada
340 Four Valley Drive
Vaughan, Ontario L4K 5Z1
Phone: (905) 695-6066

These instructions do not purport to cover all the details or variations in the equipment described, nor do they provide for every possible contingency to be met in connection with installation, operation and maintenance. All specifications subject to change without notice. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to Badger Fire Protection, Charlottesville, VA

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