Department of Energy

Condition Assessment Survey (CAS) Program

Deficiency Standards & inspections Methods Manual

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Assembly/Component	Control Number
STANDARD	
Equipment Controls..	GSS 0.08.01.05
Motors	GSS 0.08.01.07
Pipes & Accessories	GSS 0.08.01.08
Pumps..	GSS 0.08.01.09
Tanks & Sumps	GSS 0.08.01.13
Water Conditioners	GSS 0.08.01.14
Water Heaters	GSS 0.08.01.15
NON-STANDARD	
Equipment Controls..	GSNS 0.08.01.05
Motors	GSNS 0.08.01.07
Pipes & Accessories..	..GSN S 0.08.01.08
Pumps..	GSNS 0.08.01.09
Tanks & Sumps	GSNS 0.08.01.13
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GUIDE SHEET CROSS REFERENCE TABLES

GUIDE SHEETS

The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Drain, Waste, and Vent System inspection.

Assembly/Component	Control Number
STANDARD	
Equipment Controls..	GSS 0.08.01.05
Interceptors, Traps, & Drains	GSS 0.08.01.06
Motors	GSS 0.08.01.07
Pipes & Accessories..	GSS 0.08.01.08
Pumps..	GSS 0.08.01.09
Sewage Ejectors	GSS 0.08.01 .11
Tanks & Sumps..	GSS 0.08.01.13
NON-STANDARD	
Equipment Controls..	GSNS 0.08.01.05
Interceptors, Traps, & Drains	GSNS 0.08.01.06
Motors	GSNS 0.08.01.07
Pipes & Accessories..	GSNS 0.08.01.08
Pumps..	GSNS 0.08.01.09
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Tanks & Sumps..	GSNS 0.08.01.13

GUIDE SHEET CROSS REFERENCE TABLES

GUIDE SHEETS

The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Compressed Air System inspection.

Assembly/Component	Control Number
STANDARD	
Air Compressors	GSS 0.08.01.01
Automated Desiccant Air Dryers	GSS 0.08.01.02
Equipment Controls	GSS 0.08.01.05
Motors	GSS 0.08.01.07
Pipes & Accessories	GSS 0.08.01.08
Refrigerated Air Dryers	GSS 0.08.01.10
Tanks & Sumps	GSS 0.08.01.13
NON-STANDARD	
Air Compressors	GSNS 0.08.01.01
Automated Desiccant Air Dryers	GSNS 0.08.01.02
Equipment Controls	GSNS 0.08.01.05
Motors	GSNS 0.08.01.07
Pipes & Accessories	GSNS 0.08.01.08
Refrigerated Air Dryers	GSNS 0.08.01.10
Tanks & Sumps	GSNS 0.08.01.13

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GUIDE SHEETS

The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Vacuum System inspection.

Assembly/Component	Control Number
STANDARD	
Air Compressors..	GSS 0.08.01 .01
Equipment Controls..	GSS 0.08.01.05
Motors	GSS 0.08.01.07
Pipes & Accessories	GSS 0.08.01.08
Tanks & Sumps..	GSS 0.08.01.13
NON-STANDARD	
Air Compressors..	GSNS 0.08.01 .01
Equipment Controls..	GSNS 0.08.01.05
Motors	GSNS 0.08.01.07
Pipes & Accessories	GSNS 0.08.01.08
Tanks & Sumps..	GSNS 0.08.01.13

GUIDE SHEET CROSS REFERENCE TABLES

GUIDE SHEETS

The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Gas System inspection.

Assembly/Component	Control Number
STANDARD	
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Pipes & Accessories	GSS 0.08.01.08
NON-STANDARD	
Compressed Gas Storage Tanks	GSNS 0.08.01.03
Pipes & Accessories	GSNS 0.08.01.08

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GUIDE SHEETS

The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Wet Pipe Sprinkler System inspection.

Assembly/Component	Control Number
STANDARD	
Alarm Check Valves..	GSS 0.08.02.01
Detectors, Alarms, Operating Devices..	GSS 0.08.02.02
Engines..	GSS 0.08.01.04
Equipment Controls..	GSS 0.08.01.05
Motors..	GSS 0.08.01.07
Pipes, Fittings, Valves, Supports..	GSS 0.08.02.04
Pumps..	GSS 0.08.01.09
NON-STANDARD	
Alarm Check Valves..	GSNS 0.08.02.01
Engines	GSNS 0.08.01.04
Equipment Controls..	GSNS 0.08.01.05
Motors	GSNS 0.08.01.07
Pipes, Fittings, Valves, Supports..	GSNS 0.08.02.04
Pumps..	GSNS 0.08.01.09

GUIDE SHEET CROSS REFERENCE TABLES

GUIDE SHEETS

The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Dry Pipe Sprinkler System inspection.

Assembly/Component	Control Number
STANDARD	
Air Compressors..	GSS 0.08.01 .01
Alarm Check Valves	GSS 0.08.02.01
Detectors, Alarms, Operating Devices..	GSS 0.08.02.02
Engines	GSS 0.08.01.04
Equipment Controls	GSS 0.08.01.05
Motors	GSS 0.08.01.07
Pipes, Fittings, Valves, Supports..	GSS 0.08.02.04
Pumps..	GSS 0.08.01.09
NON-STANDARD	
Air Compressors	GSNS 0.08.01 .01
Alarm Check Valves	GSNS 0.08.02.01
Engines	GSNS 0.08.01.04
Equipment Controls..	GSNS 0.08.01.05
Motors	GSNS 0.08.01.07
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Pumps..	GSNS 0.08.01.09

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The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Standpipe System inspection.

Assembly/Component	Control Number
STANDARD	
Engines.	GSS 0.08.01.04
Equipment Controls..	GSS 0.08.01.05
Detectors, Alarms, Operating Devices..	GSS 0.08.02.02
Hose Cabinets	GSS 0.08.02.03
Motors	GSS 0.08.01.07
Pipes, Fittings, Valves, Supports..	GSS 0.08.02.04
Pumps..	GSS 0.08.01.09
NON-STANDARD	
Engines	GSNS 0.08.01.04
Equipment Controls	GSNS 0.08.01.05
Motors	GSNS 0.08.01.07
Pipes, Fittings, Valves, Supports	GSNS 0.08.02.04
Pumps..	GSNS 0.08.01.09

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The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general **Halon** Fire Suppression System inspection.

Assembly/Component	Control Number
STANDARD	
Compressed Gas Storage Tanks	GSS 0.08.01.03
Detectors, Alarms, Operating Devices..	GSS 0.08.02.02
Pipes, Fittings, Valves, Supports..	GSS 0.08.02.04
NON-STANDARD	
Pipes, Fittings, Valves, Supports	GSNS 0.08.02.04

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GUIDE SHEETS

The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general CO, Fire Suppression System inspection.

Assembly/Component	Control Number
STANDARD	
Compressed Gas Storage Tanks..	GSS 0.08.01.03
Detectors, Alarms, Operating Devices..	GSS 0.08.02.02
Pipes, Fittings, Valves, Supports..	GSS 0.08.02.04
NON-STANDARD	
Pipes, Fittings, Valves, Supports	GSNS 0.08.02.04

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GUIDE SHEETS

The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Fuel Oil System inspection.

Assembly/Component	Control Number
STANDARD	
Equipment Controls..	GSS 0.08.01.05
Motors	GSS 0.08.01.07
Pipes & Accessories..	GSS 0.08.01.08
Pumps..	GSS 0.08.01.09
Storage Tanks..	GSS 0.08.01 .12
NON-STANDARD	
Equipment Controls..	GSNS 0.08.01.05
Motors	GSNS 0.08.01.07
Pipes & Accessories..	.GSNS 0.08.01.08
Pumps..	GSNS 0.08.01.09
Storage Tanks..	GSNS 0.08.01.12

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GUIDE SHEETS

The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Boiler inspection.

Assembly/Component		Control Number
STANDARD		
Boilers, Fuel-Fired	GSS	0.08.03.01
Boilers, Electric	GSS	0.08.03.02
Burners	GSS	0.08.03.03
Equipment Controls	GSS	0.08.01.05
Fans	GSS	0.08.05.03
Motors	GSS	0.08.01.07
NON-STANDARD		
Boilers, Fuel-Fired..	GSNS	0.08.03.01
Boilers, Electric..	GSNS	0.08.03.02
Burners..	GSNS	0.08.03.03
Equipment Controls..	GSNS	0.08.01.05
Fans..	GSNS	0.08.05.03
Motors	GSNS	0.08.01.07

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The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Hot Air Furnace inspection.

Assembly/Component	Control Number
STANDARD	
Burners..	GSS 0.08.03.03
Equipment Controls..	GSS 0.08.01.05
Fans..	GSS 0.08.05.03
Furnaces	GSS 0.08.03.06
Motors..	GSS 0.08.01.07
NON-STANDARD	
Burners..	GSNS 0.08.03.03
Equipment Controls..	GSNS 0.08.01.05
Fans..	GSNS 0.08.05.03
Furnaces	GSNS 0.08.03.06
Motors	GSNS 0.08.01.07

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The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Heating Hot Water Distribution System inspection.

Assembly/Component	Control Number
STANDARD	
Equipment Controls..	GSS 0.08.01.05
Motors	GSS 0.08.01.07
Pipes & Accessories	GSS 0.08.01.08
Pumps..	GSS 0.08.01.09
Storage Tanks..	GSS 0.08.01.12
Water Heaters..	GSS 0.08.01.15
NON-STANDARD	
Equipment Controls..	GSNS 0.08.01.05
Motors	GSNS 0.08.01.07
Pipes & Accessories..	GSNS 0.08.01.08
Pumps..	GSNS 0.08.01.09
Storage Tanks..	GSNS 0.08.01.12
Water Heaters	GSNS 0.08.01.15

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The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Steam Distribution and Condensate Return System inspection.

Assembly/Component	Control Number
STANDARD	
Condensate Return Tanks..	GSS 0.08.03.04
Deaerators..	GSS 0.08.03.05
Equipment Controls..	GSS 0.08.01.05
Motors..	GSS 0.08.01.07
Pipes & Accessories	GSS 0.08.01.08
Pumps..	GSS 0.08.01.09
NON-STANDARD	
Condensate Return Tanks..	GSNS 0.08.03.04
Deaerators	..GSN S 0.08.03.05
Equipment Controls..	GSNS 0.08.01.05
Motors	GSNS 0.08.01.07
Pipes & Accessories..	GSNS 0.08.01.08
Pumps..	GSNS 0.08.01.09

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GUIDE SHEETS

The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Chemical Water Treatment inspection.

Assembly/Component	Control Number
STANDARD	
Equipment Controls	GSS 0.08.01.05
Motors	GSS 0.08.01.07
Pipes & Accessories	GSS 0.08.01.08
Pumps	GSS 0.08.01.09
NON-STANDARD	
Equipment Controls	GSNS 0.08.01.05
Motors	GSNS 0.08.01.07
Pipes & Accessories	GSNS 0.08.01.08
Pumps	GSNS 0.08.01.09

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The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Terminal Heating Units inspection.

Assembly/Component	Control Number
STANDARD	
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Motors	GSS 0.08.01.07
Pipes & Accessories	GSS 0.08.01.08
Terminal Heating Units	GSS 0.08.03.07
NON-STANDARD	
Equipment Controls	GSNS 0.08.01.05
Motors	GSNS 0.08.01.07
Pipes & Accessories	GSNS 0.08.01.08
Terminal Heating Units	GSNS 0.08.03.07

GUIDE SHEET CROSS REFERENCE TABLES

GUIDE SHEETS

The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Air Handlers and Fans inspection.

Assembly/Component	Control Number
STANDARD	
Air Handlers..	GSS 0.08.05.01
Equipment Controls..	GSS 0.08.01.05
Fans..	GSS 0.08.05.03
Motors	GSS 0.08.01.07
Pipes & Accessories	GSS 0.08.01.08
NON-STANDARD	
Air Handlers	GSNS 0.08.05.01
Equipment Controls..	GSNS 0.08.01.05
Fans	GSNS 0.08.05.03
Motors	GSNS 0.08.01 .07
Pipes & Accessories..	GSNS 0.08.01 .08

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The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Ductwork and Accessories inspection.

Assembly/Component	Control Number
STANDARD	
Ductwork & Accessories	GSS 0.08.05.02
NON-STANDARD	
Ductwork & Accessories	GSNS 0.08.05.02

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The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Centrifugal Chiller inspection.

Assembly/Component	Control Number
STANDARD	
Centrifugal Compressors	GSS-08.04.02
Condensers..	GSS 0.08.04.03
Equipment Controls..	GSS 0.08.01.05
Liquid Coolers..	GSS 0.08.04.06
Motors	GSS 0.08.01.07
Pipes & Accessories..	GSS 0.08.01.08
NON-STANDARD	
Centrifugal Compressors	GSNS 0.08.04.02
Condensers..	GSNS 0.08.04.03
Equipment Controls..	GSNS 0.08.01.05
Liquid Coolers	GSNS 0.08.04.06
Motors	GSNS 0.08.01.07
Pipes & Accessories	GSNS 0.08.01.08

GUIDE SHEET CROSS REFERENCE TABLES

GUIDE SHEETS

The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Absorption Chiller System inspection.

Assembly/Component	Control Number
STANDARD	
Absorption Chillers..	GSS 0.08.04.01
Equipment Controls..	GSS 0.08.01.05
Motors	GSS 0.08.01.07
Pipes & Accessories	GSS 0.08.01.08
Pumps..	GSS 0.08.01.09
NON-STANDARD	
Absorption Chillers..	GSNS 0.08.04.01
Equipment Controls..	GSNS 0.08.01.05
Motors	GSNS 0.08.01.07
Pipes & Accessories..	.GSNS 0.08.01.08
Pumps..	GSNS 0.08.01.09

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The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Packaged Reciprocating Chiller inspection.

Assembly/Component	Control Number
STANDARD	
Condensers..	GSS 0.08.04.03
Equipment Controls..	GSS 0.08.01.05
Liquid Coolers	GSS 0.08.04.06
Motors	GSS 0.08.01.07
Packaged Chillers..	GSS 0.08.04.07
Pipes & Accessories..	GSS 0.08.01.08
NON-STANDARD	
Condensers	GSNS 0.08.04.03
Equipment Controls..	GSNS 0.08.01.05
Liquid Coolers..	GSNS 0.08.04.05
Motors	GSNS 0.08.01.07
Packaged Chillers..	GSNS 0.08.04.07
Pipes & Accessories..	GSNS 0.08.01.08

GUIDE SHEET CROSS REFERENCE TABLES

GUIDE SHEETS

The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Packaged HVAC Unit inspection.

Assembly/Component	Control Number
STANDARD	
Condensers..	GSS 0.08.04.03
Equipment Controls..	GSS 0.08.01.05
Liquid Coolers..	GSS 0.08.04.06
Motors	GSS 0.08.01.07
Packaged HVAC Units..	GSS 0.08.05.04
Pipes & Accessories	GSS 0.08.01.08
Reciprocating Compressors	GSS 0.08.04.08
NON-STANDARD	
Condensers..	GSNS 0.08.04.03
Equipment Controls..	GSNS 0.08.01.05
Liquid Coolers	GSNS 0.08.04.06
Motors	GSNS 0.08.01.07
Packaged HVAC Units..	GSNS 0.08.05.04
Pipes & Accessories..	GSNS 0.08.01.08
Reciprocating Compressors	GSNS 0.08.04.08

GUIDE SHEET CROSS REFERENCE TABLES

GUIDE SHEETS

The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Packaged Condensing Unit inspection.

Assembly/Component	Control Number
STANDARD	
Condensing Units..	GSS 0.08.04.04
Equipment Controls..	GSS 0.08.01.05
Motors	GSS 0.08.01.07
Pipes & Accessories..	GSS 0.08.01.08
Reciprocating Compressors	GSS 0.08.04.08
NON-STANDARD	
Condensing Units..	GSNS 0.08.04.04
Equipment Controls..	GSNS 0.08.01.05
Motors	GSNS 0.08.01.07
Pipes & Accessories..	.GSNS 0.08.01.08
Reciprocating Compressors	GSNS 0.08.04.08

GUIDE SHEET CROSS REFERENCE TABLES

GUIDE SHEETS

The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Refrigeration Compressor inspection.

Assembly/Component	Control Number
STANDARD	
Centrifugal Compressors	GSS 0.08.04.02
Equipment Controls..	GSS 0.08.01.05
Motors	GSS 0.08.01.07
Pipes & Accessories..	GSS 0.08.01 .08
Reciprocating Compressors	GSS 0.08.04.08
NON-STANDARD	
Centrifugal Compressors	GSNS 0.08.04.02
Equipment Controls..	GSNS 0.08.01.05
Motors..	GSNS 0.08.01.07
Pipes & Accessories..	.GSNS 0.08.01.08
Reciprocating Compressors	GSNS 0.08.04.08

GUIDE SHEET CROSS REFERENCE TABLES

GUIDE SHEETS

The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Condenser inspection.

Assembly/Component	Control Number
STANDARD	
Condensers..	GSS 0.08.04.03
Equipment Controls..	GSS 0.08.01.05
Motors	GSS 0.08.01 .07
Pipes & Accessories..	GSS 0.08.01 .08
NON-STANDARD	
Condensers	GSNS 0.08.04.03
Equipment Controls..	GSNS 0.08.01.05
Motors	GSNS 0.08.01.07
Pipes & Accessories	GSNS 0.08.01.08

GUIDE SHEET CROSS REFERENCE TABLES

GUIDE SHEETS

The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Cooling Tower inspection.

Assembly/Component	Control Number
STANDARD	
Cooling Towers..	GSS 0.08.04.05
Equipment Controls	GSS 0.08.01.05
Motors	GSS 0.08.01.07
Pipes & Accessories..	GSS 0.08.01.08
NON-STANDARD	
Cooling Towers	GSNS 0.08.04.05
Equipment Controls	GSNS 0.08.01.05
Motors	GSNS 0.08.01.07
Pipes & Accessories..	GSNS 0.08.01.08

GUIDE SHEET CROSS REFERENCE TABLES

GUIDE SHEETS

The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Chilled Water Distribution System inspection.

Assembly/Component	Control Number
STANDARD	
Equipment Controls..	GSS 0.08.01.05
Motors	GSS 0.08.01.07
Pipes & Accessories..	GSS 0.08.01.08
Pumps..	GSS 0.08.01.09
Tanks..	GSS 0.08.01.12
NON-STANDARD	
Equipment Controls..	GSNS 0.08.01.05
Motors	GSNS 0.08.01.07
Pipes & Accessories..	GSNS 0.08.01.08
Pumps..	GSNS 0.08.01.09
Tanks..	GSNS 0.08.01.12

GUIDE SHEET CROSS REFERENCE TABLES

GUIDE SHEETS

The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Condenser Water System inspection.

Assembly/Component	Control Number
STANDARD	
Equipment Controls	GSS 0.08.01.05
Motors	GSS 0.08.01.07
Pipes & Accessories	GSS 0.08.01.08
Pumps..	GSS 0.08.01.09
NON-STANDARD	
Equipment Controls..	GSNS 0.08.01.05
Motors	GSNS 0.08.01.07
Pipes & Accessories	GSNS 0.08.01.08
Pumps..	GSNS 0.08.01.09

GUIDE SHEET CROSS REFERENCE TABLES

GUIDE SHEETS

The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Chemical Water Treatment inspection.

Assembly/Component	Control Number
STANDARD	
Equipment Controls	GSS 0.08.01.05
Motors	GSS 0.08.01.07
Pipes & Accessories	GSS 0.08.01.08
Pumps	GSS 0.08.01.09
Tanks	GSS 0.08.01.12
NON-STANDARD	
Equipment Controls	GSNS 0.08.01.05
Motors	GSNS 0.08.01.07
Pipes & Accessories	GSNS 0.08.01.08
Pumps	GSNS 0.08.01.09
Tanks	GSNS 0.08.01.12

GUIDE SHEET CROSS REFERENCE TABLES

GUIDE SHEETS

The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Terminal Cooling Units inspection.

Assembly/Component	Control Number
STANDARD	
Equipment Controls	GSS 0.08.01.05
Motors	GSS 0.08.01.07
Pipes & Accessories	GSS 0.08.01.08
Terminal Cooling Units	GSS 0.08.04.09
NON-STANDARD	
Equipment Controls..	GSNS 0.08.01.05
Motors	GSNS 0.08.01.07
Pipes & Accessories..	GSNS 0.08.01.08
Terminal Heatina Units..	GSNS 0.08.04.09

GUIDE SHEET CROSS REFERENCE TABLES

GUIDE SHEETS

The following Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general Drinking Water Cooling System inspection.

Assembly/Component	Control Number
STANDARD	
Equipment Controls..	GSS 0.08.01.05
Liquid Coolers..	GSS 0.08.04.06
Motors	GSS 0.08.01.07
Packaged Chillers..	GSS 0.08.04.07
Pipes & Accessories..	GSS 0.08.01 .08
NON-STANDARD	
Equipment Controls	GSNS 0.08.01.05
Liquid Coolers	GSNS 0.08.04.05
Motors	GSNS 0.08.01.07
Packaged Chillers	GSNS 0.08.04.07
Pipes & Accessories..	.GSNS 0.08.01.08

END OF SUBSECTION

INSPECTION METHODS ▪ STANDARD

GUIDE SHEETS

Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general mechanical system inspection. Sheets have been developed for each major standard assembly/component as shown in TABLE ONE below:

TABLE ONE

Assembly/Component	Control Number	Page #
STANDARD		
General Component Guidesheets		
Air Compressors	GSS 0.08.01.01	3.2-3
Automated Desiccant Air Dryer..	GSS 0.08.01.02	3.2-5
Compressed Gas Storage Tanks..	GSS 0.08.01.03	3.2-7
Engines	GSS 0.08.01.04	3.2-9
Equipment Controls	GSS 0.08.01.05	3.2-11
Interceptors, Traps, & Drains..	GSS 0.08.01.06	3.2-13
Motors..	GSS 0.08.01.07..	3.2-15
Pipes & Accessories	GSS 0.08.01.08	3.2-17
Pumps	GSS 0.08.01.09..	3.2-19
Refrigerated Air Dryer..	GSS 0.08.01 .10	3.2-21
Sewage Ejectors	GSS 0.08.01 .11	3.2-23
Storage Tanks	GSS 0.08.01.12..	3.2-25
Tanks & Sumps	GSS 0.08.01.13	3.2-27
Water Conditioners..	GSS 0.08.01.14..	3.2-29
Water Heaters	GSS 0.08.01.15	3.2-31
Fire Svstem Specific		
Alarm Check Valves..	GSS 0.08.02.01	3.2-33
Detectors, Alarms, Operating Devices	GSS 0.08.02.02	3.2-35
Hose Cabinets	GSS 0.08.02.03..	3.2-37
Pipes, Fittings, Valves, Supports	GSS 0.08.02.04..	3.2-39
Heatina Svstem Specific		
Boilers. Fuel-Fired	GSS 0.08.03.01	3.2-41
Boilers, Electric	GSS 0.08.03.02..	3.2-43
Burners	GSS 0.08.03.03..	3.2-45
Condensate Return Tanks	GSS 0.08.03.04..	3.2-47
Deaerators	GSS 0.08.03.05..	3.2-49
Furnaces..	GSS 0.08.03.06	3.2-51
Terminal Heating Units	GSS 0.08.03.07..	3.2-53
Cooling Svstem Specific		
Absorption Chillers	GSS 0.08.04.01	3.2-55
Centrifugal Compressors..	GSS 0.08.04.02	3.2-57
Condensers	GSS 0.08.04.03..	3.2-59
Condensing Units..	GSS 0.08.04.04..	3.2-61
Cooling Towers	GSS 0.08.04.05..	3.2-63
Liquid Coolers	GSS 0.08.04.06..	3.2-65
Packaged Chillers	GSS 0.08.04.07..	3.2-67
Reciprocating Compressors	GSS 0.08.04.08	3.2-69
Terminal Cooling Units	GSS 0.08.04.09..	3.2-71

INSPECTION METHODS . STANDARD

TABLE ONE (Continued)

Assembly/Component	Control Number	Page #
STANDARD		
Ventilation		
Air Handlers	GSS 0.08.05.01	3.2-73
Ductwork & Accessories	GSS 0.08.05.02	3.2-75
Fans	GSS 0.08.05.03	3.2-77
Packaged HVAC Units	GSS 0.08.05.04	3.2-79

INSPECTION METHODS - STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: AIR COMPRESSORS
CONTROL NUMBER: GSS 0.08.01 .01

APPLICATION

This guide applies to air compressors and related components (fittings, valves, strainers, hangers, insulation, etc.) installed as part of a building utility control air system.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Motors
- Tanks & Sumps

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey and analysis. Points include:

1. Observe operation of compressor. Note start-up and shut-off pressures and the associated time interval.
2. Note any unusual noise or vibration in the compressor accessories.
3. Note any leakage in compressor, coolers, piping, and fittings.
4. Cycle relief valves. Check for proper reseating.
5. Cycle storage tank drain valve; note contamination in blowdown fluids (water, oil, solids).
6. Inspect compressor housing for stress cracks, corrosion, other physical damage.
7. Check compressor mounts for loose, damaged, missing fasteners.
8. Check pipe fittings at compressor connection for stress, leakage.
9. Check intake filter for dirt infiltration.
10. Note condition of lubrication: burned oil, inadequate level, high contamination level.
11. Inspect exterior of coolers for damaged fins.
12. Check air dryers for leaks, damage.
13. Check drive components (coupling, belts, sheaves) for wear, damage, loose fasteners.
14. Check drive for misalignment.
15. Inspect storage tank for exterior corrosion, other physical damage.

TOOLS & MATERIALS

Standard Inspection Tools - Mechanical

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INSPECTION METHODS - STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: AUTOMATED DESICCANT AIR DRYER
CONTROL NUMBER: GSS 0.08.0-I .02

APPLICATION

This guide applies to desiccant dryers and related components (fittings, valves, traps, heaters, hangers, insulation, etc.) installed for the primary purpose of removing moisture from compressed air systems.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Air Compressors

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey and analysis. Points include:

1. Check system for missing components (controls, gauges, etc.).
2. Cycle controls to ensure that all banks are operational.
3. Verify regenerative heater operation.
4. Check desiccant (if visible) for caking, contamination.
5. Inspect pipe, fittings, and components for stress cracks, corrosion, other physical damage.
6. Check mounts and supports for loose, damaged, missing fasteners.

TOOLS & MATERIALS

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INSPECTION METHODS . STANDARD

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INSPECTION METHODS . STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: COMPRESSED GAS STORAGE TANKS
CONTROL NUMBER: GSS 0.08.01.03

APPLICATION

This guide applies to all compressed gas storage tanks and related components (fittings, valves, sight glasses, hangers, insulation, etc.).

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pipes &Accessories

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey and analysis. Points include:

1. Check tank for proper operating level/pressure.
2. Note any leakage in tank, piping, and fittings.
3. Inspect tank exterior for stress cracks, corrosion, other physical damage.
4. Check tank supports for loose, damaged, missing fasteners.
5. Check pipe fittings at tank connection for stress, leakage.
6. Report any missing tanks or fittings.
7. Cycle relief valves; check proper reseating.

TOOLS & MATERIALS

Standard Inspection Tools - Mechanical

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INSPECTION METHODS - STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: ENGINES
CONTROL NUMBER: GSS 0.08.01.04

APPLICATION

This guide applies to gasoline/diesel/propane engines and related components (fittings, valves, strainers, insulation, etc.) installed as drives in building utility systems.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:
- Pipes & Accessories
- Pumps

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey and analysis. Points include:

1. Observe operation of engine.
2. Note any unusual noise or vibration in the engine or accessories.
3. Note any leakage in engine, coolers, piping, and fittings.
4. Take sample of engine oil and have tested for engine wear products.
5. Inspect engine housing for stress cracks, corrosion, other physical damage.
6. Check engine mounts for loose, damaged, missing fasteners.
7. Check pipe fittings at engine connection for stress, leakage.
8. Check intake filter for dirt infiltration.
9. Inspect exterior of coolers for damaged fins.
10. Check drive for misalignment.
11. Inspect battery charger and batteries for proper operation, physical damage, general condition.

TOOLS & MATERIALS

Standard Inspection Tools - Mechanical

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INSPECTION METHODS - STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: EQUIPMENT CONTROLS
CONTROL NUMBER: GSS 0.08.01.05

APPLICATION

This guide applies to controllers typically found on mechanical utility equipment including motor controllersswitches, and related components (sensors, wiring, fittings, and enclosures).

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Pumps
- Air Compressors
- Motors
- Fans
- Air Handlers
- Heating Equipment
- Cooling Equipment

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey, examination of building records, and analysis. Points include:

1. Check accessible control enclosures for missing components.
2. Observe system for cycling within limit setpoints: pressure, temperature, level.
3. Check visible wiring for fraying, loose connections.
4. Check BX metal clad/armored cable and conduit for corrosion, damage.
5. Check sensor mounts and supports for loose, damaged, missing fasteners.

TOOLS & MATERIALS

Standard Inspection Tools - Mechanical

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INSPECTION METHODS - STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: INTERCEPTORS, TRAPS, & DRAINS
CONTROL NUMBER: GSS 0.08.01.06

APPLICATION

This guide applies to plumbing drainage interceptors, traps, drains, and related fittings installed for the primary purpose of controlling and directing the removal of waste water and other matter from a facility.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey, examination of building records, and analysis. Points include:

1. Ensure that interceptors, traps, and drains are operational.
2. Checks units for leakage.
3. Note excessive corrosion.
4. Check mounts and supports for loose, damaged, missing fasteners.

TOOLS & MATERIALS

Standard Inspection Tools - Mechanical

INSPECTION METHODS - STANDARD

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INSPECTION METHODS ▪ STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: MOTORS
CONTROL NUMBER: GSS 0.08.01.07

APPLICATION

This guide applies to small motors and related components (conduit, fittings, switches, starters, controls, etc.) installed as drives on utility generation and distribution equipment (see note below).

SPECIAL INSTRUCTIONS

*This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pumps
- Compressors
- Fans

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey and analysis. Points include:

1. Observe motor operation. Note normal start-up and shut-off of unit and the associated time interval.
2. Inspect motor exterior housing for stress cracks, corrosion, other physical damage.
3 Check motor interior housing (open motors only) for dirt, physical damage, signs of overheating.
4. Check motor mounts for loose, damaged, missing fasteners.
5. Check conduit, BX, Greenfield connections at motor for loose or missing fittings, physical damage, improper electrical connections.
6. Check motor bearing seals for leakage.
7. Check motor for excessive temperature, vibration, noise.

TOOLS & MATERIALS

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*NOTE: Motors greater than 10 HP will be surveyed by the electrical crew.

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INSPECTION METHODS - STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: PIPE &ACCESSORIES
CONTROL NUMBER: GSS 0.08.01.08

APPLICATION

This guide applies to piping and related distribution components (fittings, valves, hangers, insulation, etc.) installed as part of a building, liquid/gas service, distribution systems, or related drainage, waste, and venting.

SPECIAL INSTRUCTIONS

1. Review manufacturer's or installer's instructions.
2. inspection should be scheduled when system is in use.
3. This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pumps
- Compressors
- Tanks & Sumps
- Water Conditioners
- Water Heaters
- Heating Equipment
- Cooling Equipment

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey and analysis. Points include:

1. Check general appearance of system.
2. Note buildup of ferrous oxide and cuprous oxide on piping surfaces, or fitting bodies.
3. Note pipe leakage locations: at corroded section, corroded or loose fittings, defective caulk joints, flexible connections.
4. Note piping distortion: bent, sagging, crimped, crushed.
5. Check piping expansion joints for proper operation: no leaks, loose fasteners.
6. Check pipe supports and hangers for defects: loose, missing fasteners; improper alignment; improper allowance for expansion.
7. Record defects in piping insulation: missing, damaged, wet.
8. Check wall and floor pipe penetrations for defects (missing seal, improper fire rating seal, lack of required flange cover or escutcheon).
9. Note any valve stem leakage: improper packing adjustment, worn or missing packing.
10. Check valves for damage: cracked housing, bent stem.
11. Check all terminal units: physical damage, leakage, loose fasteners.
12. Check general pressure, temperature, and delivery rate at terminal fixtures.
13. Check instrumentation: missing, inoperative, illegible.

TOOLS & MATERIALS

Standard Inspection Tools - Mechanical

NOTE: Fire Protection system piping has a separate standard - GSS 0.08.02.04.

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INSPECTION METHODS - STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: PUMPS
CONTROL NUMBER: GSS 0.08.01.09

APPLICATION

This guide applies to all pumps and related components (fittings, valves, strainers, hangers, insulation, etc.) installed as part of a building utility generation and distribution systems and related drainage, waste, and venting systems.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

inspect associated:

- Pipes & Accessories
- Motors
- Tanks & Sumps

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey and analysis. Points include:

1. Verify flow through unit.
2. Monitor flow gauges. Check reading against rating, check defects.
3. Monitor discharge head gauge. Check reading against rating, check defects.
4. Check pump for excessive vibration, noise.
5. Check operation of pressure and level controls: proper pump cut-in and cut-out.
6. Inspect pump housing for stress cracks, corrosion, other physical damage.
7. Check pump mounts for loose, damaged, missing fasteners.
8. Check pump packing/seals for leakage.
9. Check pump shafting for wear.
10. Note condition of lubrication of pump bearings.
11. Check coupling for wear, damage, loose fasteners.
12. Check coupling for leakage.
13. Check coupling guard: present and secure.
14. Check pipe fittings at pump connection for stress, leakage.
15. Check all piping and fittings within 10 feet of pump for damaged or missing support, loose or missing fasteners.
16. Inspect piping and fittings for leaks, corrosion.
17. Check that pump, pipe, and fitting insulation is properly installed.
18. Note level and pressure in expansion tank. Check reading against rating, check defects
19. Check exterior of expansion tank for corrosion, leaks.
20. Check instrumentation: missing, inoperative, illegible.

TOOLS & MATERIALS

Standard Inspection Tools - Mechanical

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INSPECTION METHODS - STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: REFRIGERATED AIR DRYERS
CONTROL NUMBER: GSS 0.08.01 .10

APPLICATION

This guide applies to refrigeration compressors, evaporators, condensers, and related components (fittings, valves, traps, sight glasses, hangers, insulation, etc.) installed for the primary purpose of removing moisture from compressed air systems.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:
- Pipes & Accessories
- Air Compressors

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey, examination of building records, and analysis. Points include:

1. Check system for missing major components.
2. Observe that system is operational.
3. Determine presence of excessive noise or vibration.
4. Check for proper operating pressures.
5. Cycle moisture trap manual bypass. Check effluent quantity (if excessive, trap is not working) and contamination (oil passage by compressor, pipe scaling).
6. Check condenser fins for damage, dirt, corrosion.
7. Inspect pipe, fittings, and components for stress cracks, corrosion, other physical damage.
8. Check mounts and supports for loose, damaged, missing fasteners.

TOOLS & MATERIALS

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INSPECTION METHODS - STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: SEWAGE EJECTORS
CONTROL NUMBER: GSS 0.08.01 .11

APPLICATION

This guide applies to sewage ejectors and related components (fittings, valves, floats, sight glasses, hangers, etc.).

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:
- Pipes & Accessories
- Equipment Controls

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey and analysis. Points include:

1. Check ejector for proper operating level/pressure.
2. Note any leakage in ejector, piping, and fittings.
3. Inspect ejector exterior for stress bulges or cracks, corrosion, other physical damage.
4. Check ejector supports for loose, damaged, missing fasteners.

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INSPECTION METHODS - STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: STORAGE TANKS
CONTROL NUMBER: GSS 0.08.01 .12

APPLICATION

This guide applies to all liquid storage tanks and related components (fittings, valves, floats, sight glasses, hangers, insulation, etc.) installed as part of a building utility generation and distribution system.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Pumps
- Equipment Controls

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey and analysis. Points include:

1. Check tank for proper operating level/pressure.
2. Flush tank drain and check for contamination in effluent.
3. Cycle relief valve (pressurized tanks only), check for proper reseating.
4. Check that proper level/pressure is quickly restored.
5. Note any leakage in tank, piping, and fittings.
6. inspect tank exterior for stress cracks, corrosion, other physical damage.
7. Check tank supports for loose, damaged, missing fasteners.
8. Check pipe fittings at tank connection for stress, leakage.
9. Check that tank insulation is properly installed.

TOOLS & MATERIALS

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INSPECTION METHODS - STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: TANKS & SUMPS
CONTROL NUMBER: GSS 0.08.01.13

APPLICATION

This guide applies to collection/expansion tanks, sumps, and related components (fittings, valves, floats, sight glasses, hangers, insulation, etc.) in building utility generation and distribution systems and their related drainage, waste, and venting systems.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Pumps
- Motors
- Water Conditioners
- Water Heaters

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey and analysis. Points include:

1. Check tank for proper operating level/pressure.
2. Flush tank drain and check for contamination in effluent.
3. Cycle relief valve (pressurized tanks only), check for proper reseating.
4. Check that proper level/pressure is quickly restored.
5. Note any leakage in tank, piping, and fittings.
6. Inspect tank exterior for stress cracks, corrosion, other physical damage.
7. Check tank supports for loose, damaged, missing fasteners.
8. Check pipe fittings at tank connection for stress, leakage.
9. Check that tank insulation is properly installed.

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INSPECTION METHODS - STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: WATER CONDITIONERS
CONTROL NUMBER: GSS 0.08.01 .14

APPLICATION

This guide applies to all water softeners and related components (brine tanks, fittings, valves, floats, etc.) installed as part of a building's Domestic Water Supply.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Pumps

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey and analysis. Points include:

1. Check brine tank for proper operating level/pressure.
2. Flush brine tank drain, check for contamination in effluent.
3. Inspect softener exterior for stress cracks, corrosion, other physical damage.
4. Note any leakage in softener and brine tank.
5. Check softener supports for loose, damaged, missing fasteners.
6. Check pipe fittings at softener connection for stress, leakage.

TOOLS & MATERIALS

Standard Inspection Tools - Mechanical

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INSPECTION METHODS - STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: WATER HEATERS
CONTROL NUMBER: GSS 0.08.01 .15

APPLICATION

This guide applies to all water heaters and related components (fittings, valves, strainers, hangers, insulation, etc.) installed as part of a building's utility generation and distribution system.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Pumps
- Tanks & Sumps

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey and analysis. Points include:

1. Check temperature and pressure gauges for proper operation and calibration.
2. Monitor temperature of supply and return. Validate supply in acceptable temperature 120-140°F for normal domestic supply, 1 80°F for commercial dishwasher supply.
3. Note any unusual noise or vibration in the heater and accessories.
4. Cycle pressure relief valves, check for proper reseating.
5. Check fuel-fired units for unusual odors indicating poor combustion.
6. Check exhaust of fuel-fired units for smoking.
7. Drain some water from heater, check effluent for sediment.
8. Inspect heater housing for stress cracks, corrosion, other physical damage.
9. Check heater insulation for loose/missing sections, damage, wetness.
10. Check heater supports for loose, damaged, missing fasteners.
11. Check pipe fittings at heater connection for stress, leakage.
12. Note any leakage (oil, gas, steam, water) in heater, piping, and fittings.

TOOLS & MATERIALS

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INSPECTION METHODS - STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: ALARM CHECK VALVES
CONTROL NUMBER: GSS 0.08.02.01

APPLICATION

This guide applies to alarm check valves, dry pipe valves, and related components (fittings, valves, strainers, hangers, etc.) installed in wet pipe and dry pipe sprinkler systems.

SPECIAL INSTRUCTIONS

1. This is a general inspection and specific deficiencies should be handled on a service or repair call basis.
2. This inspection will generate an alarm: notify affected personnel (fire-department as needed) before proceeding.

CONCURRENT ACTIONS

Inspect associated:
- Pipes & Accessories

INSPECTION ACTIONS

Condition Assessment Survey of Fire Protection Subsystems includes visual survey and analysis. Points include:

1. Check general condition of valve exterior.
2. Note any corrosion, leakage, physical damage.
3. Conduct a trip test.
4. Reset system.
5. Report difficulties/failure of alarm to transmit, restricted water flow, and/or problems with valve cycling.

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INSPECTION METHODS . STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: DETECTORS, ALARMS, & OPERATING DEVICES
CONTROL NUMBER: GSS 0.08.02.02

APPLICATION

This guide applies to all fire and smoke detectors, alarms, control and operating devices, and related components (conduit, BX, fittings, etc.) installed in Fire Protection distribution systems.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pumps
- Pipes & Accessories

INSPECTION ACTIONS

Condition Assessment Survey of Fire Protection Subsystems includes visual survey and analysis. Points include:

1. Inspect all detectors, manual and automated trips, bells, gongs, and indicating lights associated with the system.
2. Record any leakage, corrosion, physical damage.
3. Check that guards are properly installed on manual trips/releases.
4. Check device mounts for loose, damaged, missing fasteners.
5. Check conduit, MC, Greenfield connections at device for loose or missing fittings, physical damage, improper electrical connections.
6. Report any missing devices.

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GUIDE SHEET

SYSTEM/COMPONENT: HOSE CABINETS
CONTROL NUMBER: GSS 0.08.02.03

APPLICATION

This guide applies to hose cabinets and related components (fittings, valves, hoses etc.) installed in standpipe systems for Fire Protection.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories

INSPECTION ACTIONS

Condition Assessment Survey of Fire Protection Subsystems includes visual survey and analysis. Points include:

1. Note general condition of cabinet. Record physical damage, broken, missing glass, etc.
2. Note any missing components: hose, rack, wrenches, nozzle.
3. Inspect pipe and valve inside cabinet. Note any corrosion, leakage.
4. Check rack for damage, smooth operation.
5. Note any physical damage to the hose: cracks, tears, fraying, etc.

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GUIDE SHEET

SYSTEM/COMPONENT: PIPES, FITTINGS, VALVES, & SUPPORTS
CONTROL NUMBER: GSS 0.08.02.04

APPLICATION

This guide applies to piping and related distribution components (fittings, valves, hangers, insulation, etc.) for all Fire Protection water/gas distribution systems.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pumps
- Compressors
- Compressed Gas Tanks
- Water Tanks
- Alarm Valves

INSPECTION ACTIONS

Condition Assessment Survey of Fire Protection Subsystems includes visual survey, examination of building records, and analysis. Points include:

1. Check general appearance of system.
2. Note buildup of ferrous oxide and cuprous oxide on piping surfaces.
3. Note pipe leakage locations: at corroded section, corroded or loose fittings, defective caulk joints.
4. Note piping distortion: bent, sagging, crimped, crushed.
5. Check piping expansion joints for proper operation: no leaks, loose fasteners.
6. Check pipe supports and hangers for defects: loose, missing fasteners; improper alignment; improper allowance for expansion.
7. Record defects in piping insulation: missing, damaged, wet.
8. Check wall and floor pipe penetrations for defects: missing seal, improper fire rating seal, lack of required flange cover or escutcheon.
9. Note any valve stem leakage: improper packing adjustment, worn or missing packing.
10. Check valves for damage: cracked housing, bent stem.
11. Note general condition of instrument casings. Record physical damage, broken, missing glass, etc.
12. Note any missing components.
13. Report instruments that are inoperative, illegible, obviously inaccurate.
14. Report system sprinklers/nozzles that are missing, leaking, corroded, or otherwise damaged.

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GUIDE SHEET

SYSTEM/COMPONENT: BOILERS, FUEL-FIRED
CONTROL NUMBER: GSS 0.08.03.01

APPLICATION

This guide applies to all fuel-fired boilers and related components (fittings, valves, strainers, insulation, etc.) installed for heating steam generation.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories

INSPECTION ACTIONS

Condition Assessment Survey of Heating Subsystems includes visual survey and analysis. Points include:

1. Check temperature, pressure, and level instrumentation for proper operation. Note any defects, inaccuracies, illegibility, or missing components.
2. Observe unit through an operating cycle. Note proper purging on start-up and shut-down.
3. Note any unusual noise or vibration in the boiler casing. Check for pulsations.
4. Check for unusual odors or flame color, indicating poor combustion.
5. Inspect outer casing for stress cracks, corrosion, other physical damage.
6. Check base of casing for signs of leakage.
7. Check manholes and handholes for corrosion, leakage.
8. Check all piping, fittings, flanges within 10 feet of boiler for corrosion, leakage, loose or missing fasteners, physical abuse.
9. Check insulation for loose/missing sections, damage, wetness.
10. Cycle pressure relief valves, check for proper reseating.
11. Examine valves for packing leakage, excessive corrosion. Note any damage to operating mechanisms.
12. Check boiler and piping supports for loose, damaged, missing fasteners.
13. Check integral fan housings for corrosion, leakage, damage.
14. Check fan motor for proper operation. Note any corrosion, physical damage.
15. Note any unusual noise, excessive vibration in the fan/motor assembly.
16. Check breeching, chimney, stack for excessive corrosion, loose fasteners, leakage.
17. Note any damage in air flow dampers and linkage.
18. Examine exposed parts of economizer, superheater, soot blowers, etc. for any signs of leakage, damage, loose or missing fasteners.
19. Examine integral equipment controls and wiring.
20. Note any inoperative motor starters.
21. Check conduit, control housings, and panels for corrosion, leakage.
22. Note any controls that have been bypassed for operation.

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GUIDE SHEET

SYSTEM/COMPONENT: BOILERS, ELECTRIC
CONTROL NUMBER: GSS 0.08.03.02

APPLICATION

This guide applies to all electric boilers and related components (fittings, valves, strainers, hangers, insulation, etc.) for all heating steam generation and distribution systems.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories

INSPECTION ACTIONS

Condition Assessment Survey of Heating Subsystems includes visual survey and analysis. Points include:

1. Check temperature, pressure, and level instrumentation for proper operation. Note any defects, inaccuracies, illegibility, or missing components.
2. Note any unusual noise or vibration in the boiler casing. Check for pulsations.
3. Inspect outer casing for stress cracks, corrosion, other physical damage.
4. Check base of casing for signs of leakage.
5. Check manholes and handholes for corrosion, leakage.
6. Check all piping, fittings, flanges within 10 feet of boiler for corrosion, leakage, loose or missing fasteners, physical abuse.
7. Check insulation for loose/missing sections, damage, wetness.
8. Cycle pressure relief valves, check for proper reseating.
9. Examine valves for packing leakage, excessive corrosion. Note any damage to operating mechanisms.
10. Check boiler and piping supports for loose, damaged, missing fasteners.
11. Examine integral equipment controls and wiring.
12. Check conduit, control housings, and panels for corrosion, leakage.
13. Note any controls that have been bypassed for operation.

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GUIDE SHEET

SYSTEM/COMPONENT: BURNERS
CONTROL NUMBER: GSS 0.08.03.03

APPLICATION

This guide applies to burners for fuel-fired water heaters, steam generators, furnaces, and related components (fittings, valves, strainers, hangers, insulation, etc.) for all space heating systems.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Boilers
- Water Heaters

INSPECTION ACTIONS

Condition Assessment Survey of Heating Subsystems includes visual survey and analysis. Points include:

1. Check burner temperature, pressure, and draft instruments for proper operation. Note any damage, leaks, inaccuracy, or illegibility.
2. Note any unusual noise or vibration.
3. Check for unusual odors or flame color, indicating poor combustion.
4. Inspect burner housing for stress cracks, corrosion, other physical damage.
5. Check fuel/air control dampers for wear, damage, loose fasteners.
6. Check fuel valves for signs of leakage, binding.
7. Check pipe and fittings at burner connection for stress, cracks, fatigue.
8. Note any corrosion or leakage (oil, gas, steam, water) in burner, piping, and fittings.
9. Check integral air compressors/fans for noise or vibration.

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GUIDE SHEET

SYSTEM/COMPONENT: CONDENSATE RETURN TANKS
CONTROL NUMBER: GSS 0.08.03.04

APPLICATION

This guide applies to all condensate return tanks and related components (fittings, valves, strainers, hangers, insulation, etc.) installed as part of a heating steam distribution system.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Pumps
- Motors
- Equipment Controls

INSPECTION ACTIONS

Condition Assessment Survey of Heating Subsystems includes visual survey and analysis. Points include:

1. Check temperature, pressure, and level instruments for proper operation. Note any damage, inaccuracies, illegibility, or missing components.
2. Observe unit through a pumping cycle. Check for proper level cut-in and cut-out.
3. Note any unusual noise or vibration.
4. Drain some water from unit. Check effluent for sediment.
5. Inspect shell exterior for stress cracks, corrosion, other physical damage.
6. Check base of unit for signs of leakage.
7. Check manholes and handholes for corrosion, leakage.
8. Check all piping, fittings, flanges within 10 feet of unit for corrosion, leakage, loose or missing fasteners, physical abuse.
9. Check insulation for loose/missing sections, damage, wetness.
10. Examine valves for packing leakage, excessive corrosion. Note any damage to operating mechanisms.
11. Check return tank and piping supports for loose, damaged, missing fasteners.
12. Examine integral equipment controls and wiring.
13. Note any inoperative motor starters.
14. Check conduit, control housings, and panels for corrosion, leakage.
15. Note any controls that have been bypassed for operation.

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GUIDE SHEET

SYSTEM/COMPONENT: DEAERATORS
CONTROL NUMBER: GSS 0.08.03.05

APPLICATION

This guide applies to all deaerators and related components (fittings, valves, strainers, hangers, insulation, etc.) included in heating steam and condensate return systems.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Pumps
- Motors
- Equipment Controls

INSPECTION ACTIONS

Condition Assessment Survey of Heating Subsystems includes visual survey and analysis. Points include:

1. Check temperature, pressure, and level instruments for proper operation. Note any damage, inaccuracies, illegibility, or missing components.
2. Observe unit through a pumping cycle. Check for proper level cut-in and cut-out.
3. Note any unusual noise or vibration.
4. Drain some water from unit. Check effluent for sediment.
5. Inspect shell exterior for stress cracks, corrosion, other physical damage.
6. Check base of unit for signs of leakage.
7. Check manholes and handholes for corrosion, leakage.
8. Check all piping, fittings, flanges within 10 feet of unit for corrosion, leakage, loose or missing fasteners, physical abuse.
9. Check insulation for loose/missing sections, damage, wetness.
10. Examine valves for packing leakage, excessive corrosion. Note any damage to operating mechanisms.
11. Check deaerator and piping supports for loose, damaged, missing fasteners.
12. Examine integral equipment controls and wiring.
13. Note any inoperative motor starters.
14. Check conduit, control housings, and panels for corrosion: leakage.
15. Note any controls that have been bypassed for operation.

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GUIDE SHEET

SYSTEM/COMPONENT: FURNACES
CONTROL NUMBER: GSS 0.08.03.06

APPLICATION

This guide applies to all furnaces and related components (fittings, valves, strainers, hangers, insulation, etc.) installed as part of a heating hot air distribution system.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Pumps

INSPECTION ACTIONS

Condition Assessment Survey of Heating Subsystems includes visual survey and analysis. Points include:

1. Check temperature and draft instrumentation for proper operation. Note any defects, inaccuracies, illegibility, or missing components.
2. Observe unit through an operating cycle. Note proper purging on start-up and shut-down.
3. Note any unusual noise or vibration in the furnace casing. Check for pulsations.
4. Check for unusual odors or flame color, indicating poor combustion.
5. Inspect outer casing for stress cracks, corrosion, other physical damage.
6. Check casing for signs of leakage.
7. Check all piping, fittings, flanges within 10 feet of furnace for corrosion, leakage, loose or missing fasteners, physical abuse.
8. Check insulation for loose/missing sections, damage.
9. Examine valves for packing leakage, excessive corrosion. Note any damage to operating mechanisms.
10. Check furnace and piping supports for loose, damaged, missing fasteners.
11. Check integral fan housings for corrosion, leakage, damage.
12. Check fan motor for proper operation. Note any corrosion, physical damage.
13. Note any unusual noise, excessive vibration in the fan/motor assembly.
14. Check breeching, chimney, stack for excessive corrosion, loose fasteners, leakage.
15. Note any damage in air flow dampers and linkage.
16. Examine exposed parts of air cleaner, humidifier, etc. for any signs of leakage, damage, loose or missing fasteners.
17. Examine integral equipment controls and wiring.
18. Note any inoperative motor starters.
19. Check conduit, control housings, and panels for corrosion, leakage.
20. Note any controls that have been bypassed for operation.

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GUIDE SHEET

SYSTEM/COMPONENT: TERMINAL HEATING UNITS
CONTROL NUMBER: GSS 0.08.03.07

APPLICATION

This guide applies to all terminal heating units and related components (fittings, valves, ducts, hangers, insulation, etc.) installed as part of an HVAC distribution system.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Ductwork & Accessories
- Motors
- Equipment Controls

INSPECTION ACTIONS

Condition Assessment Survey of Heating Subsystems includes visual survey and analysis. Points include:

1. Check units for proper operation.
2. Note excessive noise or vibration.
3. Check that fan speed controls are operative.
4. Cycle thermostat to check proper response from heating control valve and fan.
5. Inspect unit housing for corrosion, other physical damage.
6. Note any leakage (air, steam, water) in unit, piping, and fittings.
7. Note any controls that have been bypassed or rendered inoperative.

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GUIDE SHEET

SYSTEM/COMPONENT: ABSORPTION CHILLERS
CONTROL NUMBER: GSS 0.08.04.01

APPLICATION

This guide applies to all Absorption Chillers and related components (pumps, fittings, valves, strainers, hangers, insulation, etc.) included in HVAC Cooling Systems.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Pumps

INSPECTION ACTIONS

Condition Assessment Survey of Cooling Subsystems includes visual survey and analysis. Points include:

1. Check temperature, pressure, and level instrumentation for proper operation. Note any defects, inaccuracies, illegibility, or missing components.
2. Check temperature, pressure, and level readings. Validate consistency with load and refrigerant characteristics.
3. Note any unusual noise or vibration in the chiller.
4. Inspect exterior shells (evaporator, absorber, generator, condenser) for cracks, corrosion, leakage, other physical damage.
5. Check all access plates, heads for seal leakage.
6. Check insulation for loose/missing sections, damage, wetness.
7. Check all piping, fittings, flanges within 10 feet of the chiller for corrosion, leakage, loose or missing fasteners, physical abuse.
8. Examine valves for leakage, excessive corrosion. Note any damage to operating mechanisms.
9. Check chiller and piping supports for loose, damaged, missing fasteners.
10. Examine integral equipment controls and wiring.
11. Note any inoperative motor starters.
12. Check conduit, control housings, and panels for corrosion, leakage.
13. Note any controls that have been bypassed for operation.

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GUIDE SHEET

SYSTEM/COMPONENT: CENTRIFUGAL COMPRESSORS
CONTROL NUMBER: GSS 0.08.04.02

APPLICATION

This guide applies to all centrifugal refrigeration compressors and related components (fittings, integral pumps, valves, strainers, insulation, etc.) installed as components in Cooling Chiller Systems.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Motors
- Pipes & Accessories
- Condensers
- Liquid Coolers

INSPECTION ACTIONS

Condition Assessment Survey of Cooling Subsystems includes visual survey and analysis. Points include:

1. Check temperature and pressure gauges for proper operation.
2. Monitor temperature/pressure of suction and discharge. Validate in acceptable range: consistent with load and refrigerant characteristics.
3. Note any unusual noise or vibration in the compressor and accessories.
4. Inspect compressor housing for stress cracks, corrosion, other physical damage.
5. Check insulation for loose/missing sections, damage, wetness.
6. Check compressor supports for loose, damaged, missing fasteners.
7. Check compressor drive shafting for defective seals.
8. Check drive coupling for loose fasteners, leakage, gross misalignment.
9. Inspect load vane shafting for defective seal, binding, loose fasteners.
10. Check oil sump for leakage, pump noise, proper heater/cooler operation.
11. Check pipe fittings at compressor connection for stress, leakage.
12. Note any leakage (oil, refrigerant, water) in compressor, piping, and fittings.
13. Examine integral equipment controls and wiring.
14. Note any inoperative motor starters.
15. Check conduit, control housings, and panels for corrosion, leakage:
16. Note any controls that have been bypassed for operation.

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GUIDE SHEET

SYSTEM/COMPONENT: CONDENSERS
CONTROL NUMBER: GSS 0.08.04.03

APPLICATION

This guide applies to all refrigerant condensers (shell and tube, air-cooled, and evaporative) and related components (piping, fittings, valves, fans, motors, etc.) installed in Cooling System Chiller Plants.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Liquid Coolers
- Compressors

INSPECTION ACTIONS

Condition Assessment Survey of Cooling Subsystems includes visual survey and analysis. Points include:

1. Check temperature, pressure, and level instrumentation for proper operation. Note any defects, inaccuracies, illegibility, or missing components.
2. Check temperature, pressure, and level readings. Validate consistency with load and refrigerant characteristics.
3. Note any unusual noise or vibration in the condenser.
4. Check for unusual odors indicating refrigerant leakage.
5. Inspect outer casing for cracks, corrosion, other physical damage.
6. Check inspection plates for signs of leakage.
7. Check finned tube section for corrosion, leakage, fin damage, air blockage (air-cooled units).
8. Inspect fan assembly for cracks, corrosion, other physical damage (air-cooled units).
9. Inspect pump assembly for cracks, corrosion, other physical damage (evaporative condensers).
10. Check sump level control for damage, defects.
11. Check all piping, fittings, flanges within 10 feet of the condenser for corrosion, leakage, loose or missing fasteners, physical abuse.
12. Examine valves for leakage, excessive corrosion. Note any damage to operating mechanisms.
13. Check condenser and piping supports for loose, damaged, missing fasteners.
14. Examine integral equipment controls and wiring.
15. Note any inoperative motor starters.
16. Check conduit, control housings, and panels for corrosion, leakage.
17. Note any controls that have been bypassed for operation.

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GUIDE SHEET

SYSTEM/COMPONENT: CONDENSING UNITS
CONTROL NUMBER: GSS 0.08.04.04

APPLICATION

This guide applies to all refrigerant condensing units and related components (fittings, valves, strainers, hangers, insulation, etc.) installed as part of an HVAC Cooling system.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories

INSPECTION ACTIONS

Condition Assessment Survey of Cooling Subsystems includes visual survey and analysis. Points include:

1. Check temperature, pressure, and level instruments for proper operation. Note any damage, inaccuracies, illegibility, or missing components.
2. Check temperature, pressure, and level readings. Validate consistency with load and refrigerant characteristics.
3. Observe unit through a compression cycle. Check for proper cut-in and cut-out.
4. Note any unusual noise or vibration in the unit.
5. Inspect enclosure for cracks, corrosion, other physical damage.
6. Check access plates for signs of leakage.
7. Check finned tube condenser (air-cooled) for leakage, corrosion, bent or missing fins.
8. Check compressors for corrosion, vibration, leakage, damaged mounts.
9. Check all piping, fittings, flanges within 10 feet of the unit for corrosion, leakage, loose or missing fasteners, physical abuse.
10. Examine valves for leakage, excessive corrosion. Note any damage to operating mechanisms.
12. Check unit and piping supports for loose, damaged, missing fasteners.
13. Check conduit, control housings, and panels for corrosion, leakage.

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GUIDE SHEET

SYSTEM/COMPONENT: COOLING TOWERS
CONTROL NUMBER: GSS 0.08.04.05

APPLICATION

This guide applies to cooling towers and related components (fittings, valves, strainers, hangers, insulation, etc.) installed in HVAC Cooling Service and Distribution Systems.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Condensers
- Pumps

INSPECTION ACTIONS

Condition Assessment Survey of Cooling Subsystems includes visual survey and analysis. Points include:

1. Check temperature and level instrumentation for proper operation. Note any defects, inaccuracies, illegibility, or missing components.
2. Check temperature and level readings. Validate consistency with load and refrigerant characteristics.
3. Note any unusual noise or vibration in the tower.
4. Inspect tower frame for cracks, corrosion, wood rot, other physical damage.
5. Check basin for corrosion, leakage.
6. Check access plates for signs of leakage.
7. Check basin level control for damage, defects.
8. Check tower fill and eliminators for damage, missing sections, collapse.
9. Inspect fan assembly for cracks, corrosion, other physical damage.
10. Check tower top for missing or blocked distribution nozzles, missing or damaged inspection covers.
11. Check all piping, fittings, flanges within 10 feet of the tower for corrosion, leakage, loose or missing fasteners, physical abuse.
12. Examine valves for leakage, excessive corrosion. Note any damage to operating mechanisms.
13. Check tower and piping supports for loose, damaged, missing fasteners.
14. Examine integral equipment controls and wiring.
15. Note any inoperative motor starters.
16. Check conduit, control housings, and panels for corrosion, leakage.
17. Note any controls that have been bypassed for operation.

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GUIDE SHEET

SYSTEM/COMPONENT: LIQUID COOLERS
CONTROL NUMBER: GSS 0.08.04.06

APPLICATION

This guide applies to all liquid coolers (evaporators for chilled water) and related components (piping, fittings, valves, insulation, etc.) installed in Cooling System Chillers Plants.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Condensers
- Compressors

INSPECTION ACTIONS

Condition Assessment Survey of Cooling Subsystems includes visual survey and analysis. Points include:

1. Check temperature, pressure, and level instrumentation for proper operation. Note any defects, inaccuracies, illegibility, or missing components.
2. Check temperature, pressure, and level readings. Validate consistency with load and refrigerant characteristics.
3. Note any unusual noise or vibration in the cooler.
4. Check for unusual odors indicating refrigerant leakage.
5. Inspect outer casing for cracks, corrosion, other physical damage.
6. Check inspection plates (heads) for signs of leakage.
7. Check insulation for loose/missing sections, damage, wetness.
8. Check all piping, fittings, flanges within 10 feet of the cooler for corrosion, leakage, loose or missing fasteners, physical abuse.
9. Examine valves for leakage, excessive corrosion. Note any damage to operating mechanisms.
10. Check cooler and piping supports for loose, damaged, missing fasteners.

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GUIDE SHEET

SYSTEM/COMPONENT: PACKAGED CHILLERS
CONTROL NUMBER: GSS 0.08.04.07

APPLICATION

This guide applies to all packaged chilling units and related components (fittings, valves, strainers, hangers, insulation, etc.) installed as part of an HVAC Cooling Chilled Water System.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Pumps
- Air Handlers
- Terminal Cooling Units

INSPECTION ACTIONS

Condition Assessment Survey of Cooling Subsystems includes visual survey and analysis. Points include:

1. Check temperature, pressure, and level instruments for proper operation. Note any damage, inaccuracies, illegibility, or missing components.
2. Check temperature, pressure, and level readings. Validate consistency with load and refrigerant characteristics.
3. Observe unit through a compression cycle. Check for proper cut-in and cut-out.
4. Note any unusual noise or vibration in the chiller.
5. Inspect chiller enclosure for cracks, corrosion, other physical damage.
6. Check access plates for signs of leakage.
7. Check finned tube condenser (air-cooled) for corrosion, bent or missing fins.
8. Check evaporator insulation for loose/missing sections, damage, wetness.
9. Check compressors for corrosion, vibration, leakage, damaged mounts.
10. Check all piping, fittings, flanges within 10 feet of the tower for corrosion, leakage, loose or missing fasteners, physical abuse.
11. Examine valves for leakage, excessive corrosion. Note any damage to operating mechanisms.
12. Check chiller and piping supports for loose, damaged, missing fasteners.
13. Check conduit, control housings, and panels for corrosion, leakage.

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GUIDE SHEET

SYSTEM/COMPONENT: RECIPROCATING COMPRESSORS
CONTROL NUMBER: GSS 0.08.04.08

APPLICATION

This guide applies to all reciprocating refrigeration compressors and related components (fittings, integral pumps, valves, strainers, heaters, etc.) installed as components in Cooling Chiller, Packaged HVAC and Condensing Units Systems.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Motors
- Pipes & Accessories
- Condensers
- Liquid Coolers

INSPECTION ACTIONS

Condition Assessment Survey of Cooling Subsystems includes visual survey and analysis. Points include:

1. Check temperature and pressure gauges for proper operation.
2. Monitor temperature/pressure of suction and discharge. Validate in acceptable range: consistent with load and refrigerant characteristics.
3. Note any unusual noise or vibration in the compressor and accessories.
4. Inspect compressor housing for stress cracks, corrosion, other physical damage.
5. Check compressor supports for loose, damaged, missing fasteners.
6. Check compressor drive shafting for defective seals (open drive units).
7. Check drive coupling for loose fasteners, gross misalignment (open drive units).
8. Check oil sump for leakage, pump noise, proper operation of heater.
9. Check pipe fittings at compressor connection for stress, leakage.
10. Note any leakage (oil, refrigerant) in compressor, piping, and fittings.
11. Examine integral equipment controls and wiring.
12. Note any inoperative motor starters.
13. Check conduit, control housings, and panels for corrosion, leakage.
14. Note any controls that have been bypassed for operation.

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GUIDE SHEET

SYSTEM/COMPONENT: **TERMINAL COOLING** UNITS
CONTROL NUMBER: GSS 0.08.04.09

APPLICATION

This guide applies to all terminal Cooling units and related components (fittings, valves, ducts, hangers, insulation, etc.) installed as part of an HVAC cooling system.

SPECIAL **INSTRUCTIONS**

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT **ACTIONS**

Inspect associated:

- Pipes & Accessories
- Ductwork & Accessories

INSPECTION ACTIONS

Condition Assessment Survey of Cooling Subsystems includes visual survey and analysis. Points include:

1. Check units for proper operation.
2. Note excessive noise or vibration.
3. Check that fan speed controls are operative.
4. Cycle thermostat to check proper response from cooling control valve and fan.
5. Inspect unit housing for corrosion, other physical damage.
6. Note any leakage (air, refrigerant, water) in unit, piping, and fittings.
7. Note any controls that have been bypassed or rendered inoperative.

TOOLS & MATERIALS

Standard Inspection Tools - Mechanical

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INSPECTION METHODS - STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: AIR HANDLERS
CONTROL NUMBER: GSS 0.08.05.01

APPLICATION

This guide applies to all air handlers/heating and ventilating units and related components (air cleaners, dampers, HX coils, fittings, valves, strainers, hangers, insulation, etc.) installed as part of an HVAC air distribution system.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Pumps
- Ductwork & Accessories
- Motors
- Equipment Controls

INSPECTION ACTIONS

Condition Assessment Survey of Heating Subsystems includes visual survey and analysis. Points include:

1. Check temperature, pressure, and air flow instrumentation for proper operation. Note any defects, inaccuracies, illegibility, or missing components.
2. Note any unusual noise or vibration in the unit housing. Check for pulsations.
3. Inspect outer casing for stress cracks, corrosion, other physical damage.
4. Check base of casing for signs of leakage.
5. Check access plates and doors for corrosion, leakage, loose or missing fasteners.
6. Check exterior insulation for loose/missing sections, damage, wetness.
7. Check unit and piping supports for loose, damaged, missing fasteners.
8. Check all piping, fittings, flanges within 10 feet of unit for corrosion, leakage, loose or missing fasteners, physical abuse.
9. Examine valves for packing leakage, excessive corrosion. Note any damage to operating mechanisms.
10. Check integral fan housings for corrosion, leakage, damage.
11. Check fan motor for proper operation. Note any corrosion, physical damage.
12. Check drive guards for damage, missing components.
13. Note any unusual noise, excessive vibration in the fan/motor assembly.
14. Check heat exchange coils and frames for excessive corrosion, loose fasteners, leakage, plugging.
15. Note any damage in air flow dampers and linkage.
16. Examine exposed parts of air cleaners, humidifiers, electric heaters, etc. for any signs of leakage, damage, loose or missing fasteners.
17. Examine integral equipment controls and wiring.
18. Note any inoperative motor starters.
19. Check conduit, control housings, and panels for corrosion, leakage.
20. Note any controls that have been bypassed for operation.

INSPECTION METHODS - STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: AIR HANDLERS (Continued)
CONTROL NUMBER: GSS 0.08.05.01

TOOLS & MATERIALS

Standard Inspection Tools - Mechanical

INSPECTION METHODS . STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: DUCTWORK&ACCESSORIES
CONTROL NUMBER: GSS 0.08.05.02

APPLICATION

This guide applies to all ductwork and related components (fittings, hangers, insulation, etc.) installed as part of an HVAC ventilation system.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:
- Air Handlers
- Fans

INSPECTION ACTIONS

Condition Assessment Survey of HVAC Subsystems includes visual survey and analysis. Points include:

1. Examine exposed ductwork.
2. Note any unusual noise or vibration.
3. Inspect duct and connections for cracks, corrosion, other physical damage, leakage.
4. Examine access plates and doors. Note corrosion, leakage, loose or missing fasteners.
5. Check dampers and operators for proper operation.
6. Check insulation for loose/missing sections, damage, wetness.
7. Check supports for corrosion, damaged, loose or missing fasteners.
8. Check wall penetrations for proper fire protection: sealing and fire dampers.
9. Check filter plenums for frame corrosion, loose filter holders, other defects.
10. Check VAV boxes for water leakage from casing.
11. Check VAV boxes for inoperative recirculating fans.
12. Check VAV boxes for corrosion.
13. Check air inlet and outlet devices for corrosion, damage.

TOOLS & MATERIALS

Standard Inspection Tools - Mechanical

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INSPECTION METHODS - STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: FANS
CONTROL NUMBER: GSS 0.08.05.03

APPLICATION

This guide applies to all fans and related components installed as part of an HVAC ventilation system or installed on boilers, furnaces.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Ductwork & Accessories

INSPECTION ACTIONS

Condition Assessment Survey of Heating Subsystems includes visual survey and analysis. Points include:

1. Check air flow instrumentation for proper operation. Note any defects, inaccuracies, illegibility, or missing components.
2. Note any unusual noise or vibration in the unit housing. Check for pulsations.
3. Inspect outer casing for stress cracks, corrosion, other physical damage.
4. Check access plates and doors for corrosion, leakage, loose or missing fasteners.
5. Check unit and supports for loose, damaged, missing fasteners.
6. Check fan motor for proper operation. Note any corrosion, physical damage.
7. Check guards and screens for damage, missing components.
3. Note any unusual noise, excessive vibration in the fan/motor assembly.
9. Note any damage in air flow dampers and linkage.
10. Examine integral equipment controls and wiring.
11. Note any inoperative motor starters.
12. Check conduit, control housings, and panels for corrosion.
13. Note any controls that have been bypassed for operation.

TOOLS & MATERIALS

Standard Inspection Tools - Mechanical

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INSPECTION METHODS . STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: PACKAGED HVAC UNITS
CONTROL NUMBER: GSS 0.08.05.04

APPLICATION

This guide applies to all packaged HVAC units and related components (fittings, valves, strainers, hangers, insulation, etc.) installed as part of a Cooling System.

SPECIAL INSTRUCTIONS

This is a general inspection and specific deficiencies should be handled on a service or repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Cooling Towers
- Ductwork and Accessories

INSPECTION ACTIONS

Condition Assessment Survey of Cooling Subsystems includes visual survey and analysis. Points include:

1. Check temperature, pressure, and level instruments for proper operation. Note any damage, inaccuracies, illegibility, or missing components.
2. Check temperature, pressure, and level readings. Validate consistency with load and refrigerant characteristics.
3. Observe unit through a compression cycle. Check for proper cut-in and cut-out.
4. Note any unusual noise or vibration in the unit.
5. Inspect enclosure for cracks, corrosion, other physical damage.
6. Check access plates for signs of leakage.
7. Check finned tube condenser (air-cooled) for leakage, corrosion, bent or missing fins, air blockage.
8. Check compressors for corrosion, vibration, leakage, damaged mounts.
9. Note any unusual noise or vibration in the furnace casing (gas or oil-fired).
10. Check for unusual odors or flame color in furnace indicating poor combustion.
11. Check combustion fan housings for corrosion, leakage, damage.
12. Note any damage in air flow dampers and linkage.
13. Examine exposed parts of air cleaner, humidifier, etc. for any signs of leakage, damage, loose or missing fasteners.
14. Check all piping, fittings, flanges within 10 feet of the unit for corrosion, leakage, loose or missing fasteners, physical abuse.
15. Examine valves for leakage, excessive corrosion. Note any damage to operating mechanisms.
16. Check unit and piping supports for loose, damaged, missing fasteners.
17. Check conduit, control housings, and panels for corrosion, leakage.

TOOLS & MATERIALS

Standard Inspection Tools - Mechanical

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INSPECTION METHODS . NON-STANDARD

GUIDE SHEETS

Guide Sheets provide a general overview of the inspection methods and requirements used to provide a general mechanical system inspection. Sheets have been developed for each major non-standard assembly/component as shown in TABLE TWO below:

TABLE TWO

Assembly/Component	Control Number	Page #
NON-STANDARD		
General Component Guidesheets		
Air Compressors..	GSNS 0.08.01 .01	3.2-83
Automated Desiccant Air Dryers..	GSNS 0.08.01.02..	3.2-85
Engines..	GSNS 0.08.01.04..	3.2-87
Equipment Controls	GSNS 0.08.01.05..	3.2-89
Interceptors, Traps, & Drains..	GSNS 0.08.01.06..	3.2-91
Motors	GSNS 0.08.01.07..	3.2-93
Pipes & Accessories	GSNS 0.08.01.08..	3.2-95
Pumps..	GSNS 0.08.01.09..	3.2-97
Refrigerated Air Dryers	GSNS 0.08.01 .10..	3.2-99
Sewage Ejectors..	GSNS 0.08.01 .11	3.2-101
Storage Tanks	GSNS 0.08.01.12..	3.2-103
Tanks & Sumps..	GSNS 0.08.01.13..	3.2-105
Water Conditioners..	GSNS 0.08.01.14..	3.2-107
Water Heaters..	GSNS 0.08.01.15	3.2-109
Fire Svstem Specific		
Alarm Check Valves..	GSNS 0.08.02.01	3.2-l 11
Pipes, Fittings, Valves, Supports	GSNS 0.08.02.04..	3.2-113
Heatina Svstem Specific		
Boilers, Fuel-Fired	GSNS 0.08.03.01..	3.2-115
Boilers, Electric	GSNS 0.08.03.02..	3.2-119
Burners	GSNS 0.08.03.03..	3.2-121
Condensate Return Tanks	GSNS 0.08.03.04..	3.2-123
Deaerators	GSNS 0.08.03.05..	3.2-125
Furnaces	GSNS 0.08.03.06..	3.2-127
Terminal Heating Units..	GSNS 0.08.03.07	3.2-129
Coolina Svstem Specific		
Absorption Chillers	GSNS 0.08.04.01	3.2-131
Centrifugal Compressors..	GSNS 0.08.04.02	3.2-133
Condensers..	GSNS 0.08.04.03..	3.2-135
Condensing Units	GSNS 0.08.04.04..	3.2-137
Cooling Towers	GSNS 0.08.04.05..	3.2-139
Liquid Coolers	GSNS 0.08.04.06..	3.2-141
Packaged Chillers	GSNS 0.08.04.07..	3.2-143
Reciprocating Compressors..	GSNS 0.08.04.08..	3.2-145
Terminal Cooling Units..	GSNS 0.08.04.09..	3.2-147
Ventilation		
Air Handlers	GSNS 0.08.05.01..	3.2-149
Ductwork & Accessories..	GSNS 0.08.05.02..	3.2-151
Fans..	GSNS Q.08.05.03..	3.2-153
Packaged HVAC Units	GSNS 0.08.05.04..	3.2-15 5

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INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: AIR COMPRESSORS
CONTROL NUMBER: GSNS 0.08.01 .01

APPLICATION

This guide applies to all non-standard inspection procedures for air compressors and related components (fittings, valves, strainers, hangers, insulation, etc.) installed as part of a building utility control air system.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out of service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Motors
- Tanks & Sumps

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey, examination of building records, and analysis. Points include:

Prior to Shutdown:

1. Observe operation of compressor. Note start-up and shut-off pressures and the associated time interval.
2. Perform vibration analysis of compressor.
3. Check compressor RPM with tachometer or stroboscope: compare with manufacturer's specifications.
4. Shut off the compressor.
5. Isolate storage tank from system service.
6. Drain storage tank to ambient pressure.
7. Start compressor and record time required to reach shutoff pressure. Compare to compressor's rated capacity.
8. Draw an oil sample for chemical analysis.

Unit Shutdown:

9. Turn off unit and lock out disconnect.
10. Tag out all electrical devices.
11. Isolate unit mechanically by securing air and water lines.
12. Tag out all secured valves.
13. Open and inspect compressor.
14. Check cylinder walls (housing) for cracks, fatigue, wear, and corrosion. Check suspicious areas with dye penetrant.
15. Check pistons (vane housing, screw, impeller) for wear, corrosion, physical damage.
16. Check piston rings (vanes) for wear, cracking, breaks.
17. Check suction and discharge valves for wear, fatigue.
18. Check valve springs for signs of fatigue.

INSPECTION METHODS . NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: AIR COMPRESSORS (Continued)
CONTROL NUMBER: GSNS 0.08.01 .01

INSPECTION ACTIONS

Shutdown inspection:

19. Check vane springs for signs of fatigue.
20. Check piston pins, rods, and rod bearings for wear, fatigue, loose fasteners. Dye check stress areas.
21. Rotate shafting and check for distortion in shaft.
22. Check ring (vane, screw) clearances: compare with manufacturer's specifications.
23. Reassemble compressor.
24. Rotate compressor shaft and check for binding, rubbing in compressor/motor.
25. Measure runout play in bearings due to wear: compare with manufacturer's specifications.
26. Check intake filter housing for dirt infiltration.

Return to Service:

27. Ensure that all tools, equipment, and materials used for inspection have been removed from the unit.
28. Ensure that all guards and covers have been reinstalled.
29. Notify affected personnel and obtain permission to place unit back in service.
30. Restore valving to normal position.
31. Restore pressure in storage tank to normal.
32. Remove lockout on disconnect and restore unit to service.
33. Remove tags from all devices.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS . NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: AUTOMATED DESICCANT AIR DRYERS
CONTROL NUMBER: GSNS 0.08.01.02

APPLICATION

This guide applies to all non-standard procedures for desiccant dryers and related components (fittings, valves, traps, heaters, hangers, insulation, etc.) installed for the primary purpose of removing moisture from compressed air systems.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. This is an invasive inspection and should be performed in conjunction with system shut-down and overhaul.
4. Notify affected personnel and obtain permission to take unit out of service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Air Compressors

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey, examination of building records, and analysis. Points include:

Prior to Shutdown:

1. Perform leak test on pressurized air/gas systems using bubble test and gas leak detectors.
2. Perform moisture test on discharge air to verify drying effect.

Unit Shutdown:

3. Turn off unit and lock out disconnect.
4. Tag out all electrical devices.
5. Isolate unit mechanically by securing air lines.
6. Tag out all secured valves.
7. Open drain valves and remove air pressure from system.

Shutdown Inspection:

8. Open and inspect desiccant chambers. Check for caking, blockage, other contamination.
9. Take desiccant bed sample and send to manufacturer for analysis.
10. Open and inspect heating elements. Check for scale, corrosion, pitting.
11. Open and inspect system controls. Check contacts for pitting, burning; check wiring for fraying, loose fasteners.
12. Cycle isolation valves to check for proper operation: not binding; proper seating.
13. Inspect autodrains. Check internals for wear.

INSPECTION METHODS . NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: AUTOMATED DESICCANT AIR DRYERS (Continued)
CONTROL NUMBER: GSNS 0.08.01.02

INSPECTION ACTIONS

Return to Service:

14. Ensure that all tools, equipment, and materials used for inspection have been removed from the unit.
15. Ensure that all guards and covers have been reinstalled.
16. Notify affected personnel and obtain permission to place unit back in service.
17. Restore valving to normal position.
18. Remove lockout on disconnect and restore unit to service.
19. Remove tags from all devices.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: ENGINES
CONTROL NUMBER: GSNS 0.08.01.04

APPLICATION

This guide applies to all non-standard procedures for gasoline/diesel/propane engines and related components (fittings, valves, strainers, insulation, etc.) installed as drives in building utility systems.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out of service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Pumps

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey, examination of building records, and analysis. Points include:

Prior to Shutdown:

1. Observe operation of engine. Note start-up and shut-off pressures (sprinkler system).
2. Perform engine vibration analysis.
3. Check engine RPM with tachometer or stroboscope: compare with manufacturer's specifications.
4. Shut off the engine.
5. Draw an oil sample for chemical analysis.

Unit Shutdown:

6. Turn off unit and lock out disconnect.
7. Tag out all electrical devices.
8. Isolate unit mechanically by securing fuel and water lines.
9. Tag out all secured valves.

Shutdown Inspection:

10. Open and inspect engine.
11. Check cylinder walls (liners) for cracks, fatigue, wear, and corrosion. Check suspicious areas with dye penetrant.
12. Check pistons for wear, corrosion, physical damage.
13. Check piston rings for wear, cracking, breaks.
14. Inspect engine head and manifolds for cracks, deterioration.
15 Check suction and discharge valves for wear, fatigue.
16. Check valve springs for signs of fatigue.
17. Check piston pins, rods, and rod bearings for wear, fatigue, loose fasteners. Dye check stress areas.
18. Rotate shafting and check for distortion in shaft.

INSPECTION METHODS ▪ NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: ENGINES (Continued)
CONTROL NUMBER: GSNS 0.08.01.04

INSPECTION ACTIONS

Shutdown Inspection:

19. Check ring clearances: compare with manufacturer's specifications.
20. Reassemble engine.
21. Rotate engine shaft and check for binding, rubbing in engine.
22. Measure runout play in bearings due to wear: compare with manufacturer's specifications.
23. Check intake filter housing for dirt infiltration.
24. Check exhaust manifold and piping for corrosion, cracks, leakage.
25. Check radiator for leaks, corrosion, damage.
26. Examine cooling hoses for cracks, fraying, bulges.
27. Check all pulleys for wear, distortion.

Return to Service:

28. Ensure that all tools, equipment, and materials used for inspection have been removed from the unit.
29. Ensure that all guards and covers have been reinstalled.
30. Perform a compression test on each cylinder. Compare with manufacturer's specifications.
31. Notify affected personnel and obtain permission to place unit back in service.
32. Restore valving to normal position.
33. Remove lockout on disconnect and restore unit to service.
34. Remove tags from all devices.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: **EQUIPMENT CONTROLS**
CONTROL NUMBER: GSNS 0.08.01.05

APPLICATION

This guide applies to all non-standard procedures for controllers typically found on mechanical utility equipment. It includes motor controllers, switches, and related components (sensors, wiring, fittings, and enclosures).

SPECIAL **INSTRUCTIONS**

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. This is an invasive inspection and should be performed in conjunction with a system shut-down and overhaul.
4. Notify affected personnel and obtain permission to take unit out of service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated equipment such as:

- Pipes & Accessories
- Air Compressors
- Pumps
- Motors
- Fans
- Air Handlers

INSPECTION **ACTIONS**

Condition Assessment Survey include visual survey, examination of building records, and analysis. Points include:

Unit Shutdown:

1. Turn off unit and lock out disconnect.
2. Tag out all electrical devices.
3. Isolate devices mechanically by securing air and water lines
4. Tag out all secured valves.

Shutdown Inspection:

5. Open and inspect controller enclosures.
6. Check enclosures for corrosion.
7. Check motor starters for burned or pitted contacts, damaged casings.
8. Inspect system controls. Check contacts for pitting, burning.
9. Check wiring for fraying, loose fasteners, signs of overheating.
10. Check miscellaneous electrical components (resistors, capacitors, inductors, controller boards, etc.) for physical damage, signs of overheating.
11. Check physical condition of temperature controllers.
12. Check physical condition of pressure controllers.
13. Check physical condition of level controllers.

INSPECTION METHODS ▪ NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: EQUIPMENT CONTROLS (Continued)
CONTROL NUMBER: GSNS 0.08.01.05

INSPECTION ACTIONS

Return to Service:

14. Ensure that all tools, equipment, and materials used for inspection have been removed from the unit.
15. Ensure that all guards and covers have been reinstalled.
16. Notify affected personnel and obtain permission to place unit back in service.
17. Restore valving to normal position.
18. Remove lockout on disconnect and restore unit to service.
19. Remove tags from all devices.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: INTERCEPTORS, TRAPS, & DRAINS
CONTROL **NUMBER:** **GSNS 0.08.01.06**

APPLICATION

This guide applies to all non-standard procedures for plumbing drainage interceptors, traps, drains, and related fittings installed for the primary purpose of controlling and directing the removal of waste water and other matter from a facility.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out of service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:
. Pipes & Accessories

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey, examination of building records, and analysis. Points include:

Unit Shutdown:

1. Turn off units feeding respective interceptor, trap, or drain and lock out disconnect.
2. Tag out all electrical devices.
3. Isolate unit mechanically by securing water and waste lines.
4. Tag out all secured valves.

Shutdown Inspection:

5. Remove inspection plates.
6. Inspect unit interior: use borescope on small units.
7. Check for erosion, corrosion.
8. Check discs and seats for wear, cracks, corrosion, binding.

Return to Service:

9. Ensure that all tools, equipment, and materials used for inspection have been removed from the unit.
10. Ensure that all parts, guards, and covers have been reinstalled.
11. Notify affected personnel and obtain permission to place unit back in service.
12. Restore valving to normal position.
13. Remove lockout on disconnect and restore unit to service.
14. Remove tags from all devices.

TOOLS & MATERIALS

1. **Non-Standard Inspection** Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS - NON-STANDARD

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INSPECTION METHODS ▪ NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: MOTORS
CONTROL NUMBER: GSNS 0.08.01.07

APPLICATION

This guide applies to all non-standard procedures for small motors and related components (conduit, fittings, switches, starters, controls, etc.) installed as drives on utility generation and distribution equipment (see note below).

SPECIAL INSTRUCTIONS

1*. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out of service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:
- Pumps
- Compressors

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey, examination of building records, and analysis. Points include:

Prior to Shutdown:

1. Observe operation of motor. Note normal start-up and shut-off, and the associated time interval.
2. Check voltage at motor and current draw. Compare to motor ratings and the requirements of the associated pump or compressor.
3. Check motor RPM with tachometer or stroboscope: compare with manufacturer's specification.
4. Perform vibration analysis on the motor.

Unit Shutdown:

5. Turn off unit and lock out disconnect.
6. Tag out all electrical devices.

Shutdown Inspection:

7. Open motor and inspect interior housing for stress cracks, corrosion, other physical damage.
8. Check stator windings for dirt, moisture, physical damage, signs of overheating, loose fasteners.
9. Check rotor windings for dirt, moisture, physical damage, signs of overheating, loose fasteners.
10. Check commutator/slip rings for loose parts, physical damage, wear.
11 Check brushes for wear, proper tension.
12. Check bearings for lube leakage into motor.
13. Check motor shafting for wear.
14. Reassemble motor.

*NOTE: Motors greater than 10 HP will be surveyed by the electrical crew.

INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: MOTORS (Continued)
CONTROL NUMBER: GSNS 0.08.01.07

INSPECTION ACTIONS

Shutdown Inspection:

15. Rotate motor shaft and check for binding, rubbing.
16. Measure runout play in bearings due to wear: compare with manufacturer's specification.
17. Check alignment.
18. Open and inspect local disconnect. Check for proper tension on blading, good blade alignment, signs of overheating.
19. Open and inspect motor starter. Check for contacts for pitting, good alignment, smooth action, signs of overheating.
20. Check wiring in disconnect and starter for worn, frayed insulation, loose connections.

Return to Service:

21. Ensure that all tools, equipment, and materials used for inspection have been removed from the unit.
22. Ensure that all guards and covers have been reinstalled.
23. Notify affected personnel and obtain permission to place unit back in service.
24. Restore switches to normal position.
25. Remove lockout on disconnect and restore unit to service.
26. Remove tags from all devices.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical/Electrical
2. As required for the test being performed.

INSPECTION METHODS ▪ NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: PIPES & ACCESSORIES
CONTROL NUMBER: GSNS 0.08.01.08

APPLICATION

This guide applies to all non-standard procedures for piping and related distribution components (fittings, valves, hangers, insulation, etc.) installed as part of a building, liquid/gas service, distribution systems, or related drainage, waste, and venting.

SPECIAL INSTRUCTIONS

1. Review manufacturer's or installer's instructions.
2. Inspection should be scheduled when system is not in use.
3. This is an invasive inspection and should be performed in conjunction with a system shut-down and overhaul. Specific deficiencies should be handled on a repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pumps
- Compressors
- Motors
- Tanks & Sumps
- Water Conditioners
- Water Heaters

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey, examination of building records, and analysis. Points include:

1. Open and inspect all backflow preventors. Check for worn or loose discs and guide assemblies, worn seats; note any corrosion buildup that could interfere with preventor operation.
2. Open and inspect section of distribution piping. Check interior for scale buildup, note excessive scaling that will restrict flow through system.
3. Open critical valves (isolation, PRV, relief): check for worn or loose discs and guide assemblies, worn seats, note any corrosion buildup that could interfere with valve operation.
4. Cycle isolation valves to check for proper operation: not binding; proper seating.
5. Perform leak test on pressurized air/gas systems using ultrasonic detection or gas leak detectors.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

NOTE: Fire Protection system piping has a separate standard - GSS 0.08.02.04.

INSPECTION METHODS . NON-STANDARD

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INSPECTION METHODS ▪ NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: PUMPS
CONTROL NUMBER: GSNS 0.08.01.09

APPLICATION

This guide applies to all non-standard procedures for all pumps and related components (fittings, valves, strainers, hangers, insulation, etc.) installed as part of a building utility generation and distribution systems and related drainage, waste, and venting systems.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out-of-service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Motors
- Tanks & Sumps

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey, examination of building records, and analysis. Points include:

Prior to Shutdown:

1. Verify flow through unit.
2. Move controller set point to obtain maximum flow.
3. Monitor flow gauges and compare against rating data.
4. Monitor discharge head gauge and compare against rating data.
5. Move controller set point to obtain minimum flow.
6. Monitor flow gauges and compare against rating data.
7. Monitor discharge head gauge and compare against rating data.
8. Check operation of level controls: proper pump cut-in and cut-out.
9. Perform vibration analysis on pump bearings.

Unit Shutdown:

10. Turn off unit and lock out disconnect.
11. Tag out all electrical devices.
12. Isolate unit mechanically by securing air and water lines.
13. Tag out all secured valves.

Shutdown Inspection:

14. Open and inspect pump.
15. Check interior housing for cracks, fatigue, erosion, and corrosion. Check suspicious areas with dye penetrant.
16. Check wear (or piston) rings for wear, cracking, breaks.
17. Check suction and discharge valves for wear, fatigue.
18. Check interior shafting for signs of fatigue.

INSPECTION METHODS . NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: PUMPS (Continued)
CONTROL NUMBER: GSNS 0.08.01.09

INSPECTION ACTIONS

Shutdown Inspection:

19. Check pump shafting for damage from packing/mechanical seal.
20. Check lantern rings and distribution tubing for blockage.
21. Check impellers (pistons) for erosion/corrosion, physical damage, distortion.
22. Rotate (cycle) shafting and check for distortion in shaft.
23. Check clearances between impeller and wear rings: compare with manufacturer's specifications.
24. Check clearances between pistons and liners: compare with manufacturer's specifications. Also check ring gap.
25. Close pump.
26. Rotate (cycle) pump to check for binding.
27. Measure runout play in bearings due to wear: compare with manufacturer's specifications.
28. Check coupling for wear, damage, loose fasteners.
29. Check coupling for misalignment.
30. Open and inspect pump strainers. Check for pump internal wear products.
31. Note general condition of the strainer.
32. Check piping internal via the strainer housing to determine amount of scaling present using a borescope.
33. Cycle suction and discharge valves. Check for proper operation and seating.

Return to Service:

34. Ensure that all tools, equipment, and materials used for inspection have been removed from the unit.
35. Ensure that all guards and covers have been reinstalled.
36. Notify affected personnel and obtain permission to place unit back in service.
37. Restore valving to normal position.
38. Restore level and pressure in expansion tank to normal.
39. Remove lockout on disconnect and restore unit to service.
40. Remove tags from all devices.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS ▪ NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: REFRIGERATED AIR DRYERS
CONTROL NUMBER: GSNS 0.08.01 .10

APPLICATION

This guide applies to all non-standard procedures for refrigeration compressors, evaporators, condensers, and related components (fittings, valves, traps, sight glasses, hangers, insulation, etc.) installed for the primary purpose of removing moisture from compressed air systems.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. This is an invasive inspection and should be performed in conjunction with a system shut-down and overhaul.
4. Notify affected personnel and obtain permission to take unit out-of-service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Air Compressors

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey, examination of building records, and analysis. Points include:

Prior to Shutdown:

1. Perform leak test on pressurized air/gas systems using bubble test and gas leak detectors.
2. Monitor discharge head, evaporator temperature, and discharge humidity and compare against rating data.

Unit Shutdown:

3. Turn off unit and lock out disconnect.
4. Tag out all electrical devices.
5. Isolate unit mechanically by securing air and water lines.
6. Tag out all secured valves.
7. Open drain valves and remove air pressure from system.

Shutdown Inspection:

8. Open and inspect moisture trap. Check for worn or loose discs and guide assemblies, worn seats; note any corrosion buildup that could interfere with trap operation.
9. Open and inspect system controls. Check contacts for pitting, burning; check wiring for fraying, loose fasteners.
10. Cycle isolation valves to check for proper operation: not binding; proper seating.

INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: REFRIGERATED AIR DRYERS
CONTROL NUMBER: GSNS 0.08.01.10

INSPECTION ACTIONS

Return to Service:

11. Ensure that all tools, equipment, and materials used for inspection have been removed from the unit.
12. Ensure that all guards and covers have been reinstalled.
13. Notify affected personnel and obtain permission to place unit back in service.
14. Restore valving to normal position.
15. Remove lockout on disconnect and restore unit to service.
16. Remove tags from all devices.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS . NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: SEWAGE EJECTORS
CONTROL NUMBER: GSNS 0.08.01 .11

APPLICATION

This guide applies to all non-standard procedures for sewage ejectors and related components (fittings, valves, floats, sight glasses, hangers, etc.).

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out-of-service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Compressors

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey, examination of building records, and analysis. Points include:

Unit Shutdown:

1. Turn off unit and lock out disconnect.
2. Tag out all electrical devices.
3. Isolate unit mechanically by securing sewage and air lines.
4. Tag out all secured valves.

Shutdown Inspection:

5. Drain ejector thoroughly.
6. Remove ejector plates and ventilate interior.
7. Inspect ejector tank interior: use borescope on small units.
8. Check interior walls for erosion, corrosion.
9. Check clappers and seats for wear, cracks, corrosion, binding.
10. Check interior float/bucket assembly for damage, distortion.
11. Check wiring for loose connections, frayed or broken insulation.
12. Check electric controls for worn or pitted contacts, improper safety devices: heaters, fuses.

Return to Service:

13. Ensure that all tools, equipment, and materials used for inspection have been removed from the unit.
14. Ensure that all parts, guards, and covers have been reinstalled.
15. Notify affected personnel and obtain permission to place unit back in service.
16. Restore valving to normal position.
17. Remove lockout on disconnect and restore unit to service.
18. Remove tags from all devices.

INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: SEWAGE EJECTORS (Continued)
CONTROL NUMBER: GSNS 0.08.01 .1 1

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: STORAGE TANKS
CONTROL NUMBER: GSNS 0.08.01.12

APPLICATION

This guide applies to all non-standard procedures for all liquid storage tanks and related components (fittings, valves, floats, sight glasses, hangers, insulation, etc.) installed as part of a building utility generation and distribution system.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out-of-service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Pumps

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey, examination of building records, and analysis. Points include:

1. Drain/pump out tank thoroughly.
2. Remove tank access plates and ventilate interior.
3. Inspect tank interior.
4. Check interior walls for erosion, corrosion.
5. Check masonry surfaces for cracks, breaks, spalling, deteriorated joints.
6. Check interior floats/rods for damage, distortion.
7. Check internal and in-line heating coils for leakage, corrosion.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools: Mechanical
2. As required for the test being performed.

INSPECTION METHODS ▪ NON-STANDARD

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INSPECTION METHODS . NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: TANKS & SUMPS
CONTROL NUMBER: GSNS 0.08.01 .13

APPLICATION

This guide applies to all non-standard procedures for collection/expansion tanks, sumps, and related components (fittings, valves, floats, sight glasses, hangers, insulation, etc.) in building utility generation and distribution system and their related drainage, waste, and venting systems.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out-of-service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Pumps
- Compressors

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey, examination of building records, and analysis. Points include:

1. Thoroughly drain or pump tank/sump.
2. Remove tank/sump access plates and ventilate interior.
3. Inspect tank/sump interior.
4. Check interior walls for erosion, corrosion.
5. Check masonry surfaces for cracks, breaks, spalling, deteriorated joints.
6. Check interior floats/rods for damage, distortion.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS . NON-STANDARD

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INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: WATER CONDITIONERS
CONTROL NUMBER: GSNS 0.08.01 .14

APPLICATION

This guide applies to all non-standard procedures for all water softeners and related components (brine tanks, fittings, valves, floats, etc.) installed as part of a building's Domestic Water Supply.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out of service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Pumps

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey, examination of building records, and analysis. Points include:

1. Drain tank.
2. Check interior for pitting, cracking, other defects.
3. Inspect spray nozzles for blockage.
4. Inspect gravel bed for caking.
5. Take zeolite bed sample and send to manufacturer or test lab for analysis.
6. Check brine tank level control for wear.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS . NON-STANDARD

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INSPECTION METHODS . NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: WATER HEATERS
CONTROL NUMBER: GSNS 0.08.01.15

APPLICATION

This guide applies to all non-standard procedures for all water heaters and related components (fittings, valves, strainers, hangers, insulation, etc.) installed as part of a building's utility generation and distribution system.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out of service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Pumps
- Storage Tanks

INSPECTION ACTIONS

Condition Assessment Survey to include visual survey, examination of building records, and analysis. Points include:

Prior to Shutdown:

1. Perform flue gas analysis on large fueled heaters.
2. Cycle thermostat/controller to check complete operation cycle of heating elements.
3. Check steam traps for leakage using sonic detectors.

Unit Shutdown:

4. Turn off unit and lock out disconnect.
5. Tag out all electrical devices.
6. Isolate unit mechanically by securing fuel and water lines.

Shutdown Inspection:

7. Tag out all secured valves.
8. Drain heater tank thoroughly.
9. Remove tank access plates and ventilate interior.
10. Inspect tank interior: use borescope on small heaters.
11. Check interior walls for erosion, corrosion.
12. Check water side of flue/tubes for erosion, corrosion, signs of overheating.
13. Remove and inspect heating elements; steam bundle, burner, electric coils; check for erosion, corrosion, physical damage, blocked burners.
14. Check flue and flow control baffles for erosion, corrosion, blockage, heat burnout or distortion.
15. Check wiring for loose connections, frayed or broken insulation.
16. Check electrical controls for worn or pitted contacts, improper safety devices: heaters, fuses.

INSPECTION METHODS ▪ NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: WATER HEATERS (Continued)
CONTROL NUMBER: GSNS 0.08.01 .15

INSPECTION ACTIONS

Return to Service:

17. Ensure that all tools, equipment, and materials used for inspection have been removed from the unit.
18. Ensure that all parts, guards, and covers have been reinstalled.
19. Notify affected personnel and obtain permission to place unit back in service.
20. Restore valving to normal position.
21. Remove lockout on disconnect and restore unit to service.
22. Remove tags from all devices.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS . NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: ALARM CHECK VALVES
CONTROL NUMBER: GSNS 0.08.02.01

APPLICATION

This guide applies to all non-standard procedures for alarm check valves and related components (fittings, valves, strainers, hangers, insulation, etc.) installed for Fire Protection.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out of service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories

INSPECTION ACTIONS

Condition Assessment Survey of Fire Protection Subsystems includes visual survey, examination of building records, and analysis. Points include:

Prior to Shutdown:

1. Perform a trip test.

Unit Shutdown:

2. Isolate the alarm valve from all sources of water.
3. Tag valves.

Shutdown Inspection:

4. Open and inspect the check valve.
5. Check clapper and seat for wear, pitting, corrosion.
6. Check hinges, latches for wear, loose fasteners.
7. Check valve interior and connecting piping for corrosion, scale blockage.

Return to Service:

8. Reset valve.
9. Notify affected personnel and obtain permission to place unit back in service.
10. Restore valving to normal position.
11. Remove tags from all devices.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS ▪ NON-STANDARD

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INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: PIPES, FITTINGS, VALVES, & SUPPORTS (FIRE SYSTEMS)
CONTROL NUMBER: GSNS 0.08.02.04

APPLICATION

This guide applies to all non-standard procedures for piping and related distribution components (fittings, valves, hangers, insulation, etc.) for all Fire Protection water/gas distribution systems.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Inspection should be scheduled when system is not in use.
3. Notify affected personnel and obtain permission to take unit out of se&ice.
4. Obtain necessary tools, equipment, and materials.
5. This is an invasive inspection and should be performed in conjunction with a system shut-down and overhaul. Specific deficiencies should be handled on a repair call basis.

CONCURRENT ACTIONS

Inspect associated:

- Pumps
- Compressors
- Compressed Gas Tanks
- Water Tanks
- Alarm Valves

INSPECTION ACTIONS

Condition Assessment Survey of Fire Protection Subsystems includes visual survey, examination of building records, and analysis. Points include:

1. Open and inspect all backflow preventors. Check for worn or loose discs and guide assemblies; worn seats; note any corrosion buildup that could interfere with preventor operation.
2. Open and inspect strainers in distribution piping. Check damage to basket, note excessive corrosion that may restrict flow or permit solids to pass through system.
3. Cycle all major valves to check for proper operation: not binding, proper seating.
4. Open critical valves. Check for worn or loose discs and guide assemblies, worn seats; note any corrosion buildup that could interfere with valve operation.
5. Open and inspect section of distribution piping. Check interior for scale buildup; note excessive scaling that will restrict flow through system.
6. With system in operation but out of normal service, cycle regulating valves to check for smooth operation and proper response to control adjustments. Record any defects, inability to obtain needed performance.
7. Perform leak test on pressurized systems using ultrasonic detection or gas leak detectors.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS - NON-STANDARD

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INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: BOILERS, FUEL-FIRED
CONTROL NUMBER: GSNS 0.08.03.01

APPLICATION

This guide applies to all non-standard procedures for all fuel-fired boilers and related components (fittings, valves, strainers, hangers, insulation, etc.) installed for heating steam generation.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out of service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Burners
- Fans
- Motors
- Equipment Controls

INSPECTION ACTIONS

Condition Assessment Survey of Heating Subsystems includes visual survey, examination of building records, and analysis. Points include:

Prior to Shutdown:

1. Perform flue gas analysis.
2. Run unit through a complete operation cycle to identify malfunctioning components.

Unit Shutdown:

3. Power down the unit consistent with department procedure.
4. Isolate and lock out disconnects.
5. Tag out all electrical devices.
6. Isolate unit mechanically by securing steam, fuel, and water lines.
7. Tag out all secured valves.

Shutdown Inspection:

8. Drain boiler thoroughly.
9. Remove access plates and ventilate interior. (Boiler should be thoroughly cleaned prior to inspection.)
10. inspect manholes and handholes. Note cracks, pitting, signs of fatigue.
11. Check steam, water, and mud drum interiors for corrosion, scale buildup. Note any shell deformation.
12. Check steam drum baffles, screens, separators for erosion, corrosion, loose or broken fasteners.
13. Check water side of boiler tubing for corrosion, scale buildup, defective joints. In water tube boilers, use a borescope to check tube areas beyond the visible curvature of the tubes.
14. Perform tube defect analysis using eddy current tester.

INSPECTION METHODS ▪ NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: BOILERS, FUEL-FIRED (Continued)
CONTROL NUMBER: GSNS 0.08.03.01

INSPECTION ACTIONS

Shutdown Inspection:

15. Check water side of any tube sheets for stress signs at tube penetrations.
16. Inspect fire side access plates and doors. Note cracks, pitting, distortion, warpage. Check sealing surfaces for damage.
17. Check steam, water, and mud drum exteriors for erosion, corrosion. Note any shell deformation, especially buckles or blisters indicating overheating, over-pressurization.
18. Check fire side of boiler tubing for erosion, corrosion, buildup of baked on fuel products, defective joints. Examine surfaces closely for indications of fatigue: stress cracks, tube deformation. Pay particular attention to superheater tubing.
19. Check insulated tubes (chrome ore, etc.) for coating damage.
20. Check tubing in area of soot blowers for signs of steam cutting.
21. Check fire side of any tube sheets for stress signs at tube penetrations.
22. Inspect the combustion chamber(s).
23. Note any refractory defects: missing, cracked, spalling.
24. Check refractory surface for signs of improper fuel flame patterns: not uniform, inadequate throw, sputtering, improper fuel shutoff.
25. Examine flue, bridge walls, and other flow control baffles for erosion, corrosion, heat blisters, buckles or other distortion.

Shutdown Inspection:

26. Inspect the interior of the fuel burner.
27. Note any heating distortion, meltdown in the gas ring, mounting plates.
28. Check oil burner cone for defects.
29. Inspect breeching/chimney access plates. Note cracks, pitting, distortion. Check sealing surfaces for damage.
30. Inspect interior of breeching, chimneys, and stacks.
31. Note excessive corrosion of interior surfaces.
32. Note buildup of soot and other fuel by-products.
33. Check operation of barometric and relief dampers.
34. Record any masonry damage.
35. Check ductwork for damage, loose or broken fasteners.
36. Cycle all valves (manual and regulating) for smooth operation and positive seating.
37. Open and inspect level control devices.
38. Check wiring for loose connections, frayed or broken insulation.
39. Check electric controls for worn or pitted contacts, improper safety devices: heaters, fuses.
40. Ensure that related fans, motors, burners, equipment controls, etc. are inspected using their respective guide sheets.
41. Perform hydrostatic test of boiler drums and tubing.
42. Ensure that all tools, equipment, and materials used for inspection have been removed from the unit.
43. Ensure that all parts, guards, and covers have been reinstalled.
44. Notify affected personnel and obtain permission to place unit back in service.
45. Restore valving to normal position.
46. Remove lockout on disconnect and restore unit to service.

INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: BOILERS, FUEL-FIRED (Continued)
CONTROL NUMBER: GSNS 0.08.03.01

INSPECTION ACTIONS

Return to Service:

47. Remove tags from all devices.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS . NON-STANDARD

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INSPECTION METHODS ▪ NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: BOILERS, ELECTRIC
CONTROL NUMBER: GSNS 0.08.03.02

APPLICATION

This guide applies to all non-standard procedures for all electric boilers and related components (fittings, valves, strainers, hangers, insulation, etc.) installed for heating steam generation.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out of service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Pumps
- Motors
- Equipment Controls

INSPECTION ACTIONS

Condition Assessment Survey of Heating Subsystems includes visual survey, examination of building records, and analysis. Points include:

Prior to Shutdown:

1. Run unit through a complete operation cycle to identify malfunctioning components.

Unit Shutdown:

2. Power down the unit consistent with department procedure.
3. Isolate and lock out disconnects.
4. Tag out all electrical devices.
5. Isolate unit mechanically by securing steam and water lines.
6. Tag out all secured valves.

Shutdown Inspection:

7. Drain boiler thoroughly.
8. Remove access plates and ventilate interior. (Boiler should be thoroughly cleaned prior to inspection.)
9. Inspect manholes. Note cracks, pitting, signs of fatigue.
10. Check shell interior for corrosion, scale buildup. Note any shell deformation.
11. Check steam baffles, screens, separators for erosion, corrosion, loose or broken fasteners.
12. Inspect the heating elements.
13. Note any damage: corrosion, sheathing breaks, signs of overheating (discoloration).
14. Check all insulators for cracks, blisters.
15. Measure heating element resistance and resistance to ground: compare to manufacturer's specifications.
16. Cycle all valves (manual and regulating) for smooth operation and proper seating.
17. Open and inspect level control devices.

INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: BOILERS, ELECTRIC (Continued)
CONTROL NUMBER: GSNS 0.08.03.02

INSPECTION ACTIONS

Shutdown Inspection:

18. Check wiring for loose connections, frayed or broken insulation.
19. Check electric controls for worn or pitted contacts, improper safety devices: heaters, fuses.
20. Ensure that related pumps, motors, equipment controls, etc. are inspected using their respective guide sheets.
21. Perform hydrostatic test of boiler shell and piping.

Return to Service:

22. Ensure that all tools, equipment, and materials used for inspection have been removed from the unit.
23. Ensure that all parts, guards, and covers have been reinstalled.
24. Notify affected personnel and obtain permission to place unit back in service.
25. Restore valving to normal position.
26. Remove lockout on disconnect and restore unit to service.
27. Remove tags from all devices.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS ▪ NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: BURNERS
CONTROL NUMBER: GSNS 0.08.03.03

APPLICATION

This guide applies to all non-standard procedures for all fuel burners and related components (fittings, valves, strainers, hangers, insulation, etc.) installed on water heaters, steam generators, and furnaces of heating systems.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installers instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out of service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Boilers
- Water Heaters

INSPECTION ACTIONS

Condition Assessment Survey of Heating Subsystems includes visual survey, examination of building records, and analysis. Points include:

Prior to Shutdown:

1. Cycle burner controller to check complete operation cycle for malfunctioning components.

Unit Shutdown:

2. Turn off unit and lock out disconnect.
3. Tag out all electrical devices.
4. Isolate unit mechanically by securing fuel lines.
5. Tag out all secured valves.

Shutdown Inspection:

6. Drain/empty burner of fuel products.
7. Check all burner mounting hardware for cracks, loose or broken fasteners. Pay particular attention to welds that may have been fatigued by thermal cycles.
8. On oil-fired units, inspect guns for stress cracks, fatigue, signs of overheating, tip damage, and other physical damage.
9. Check oil burner cone for defects.
10. Check resistance of heating elements in integral fuel oil heaters.
11. Open and inspect valves on oil atomization air compressor.
12. On gas-fired units, note any heating distortion, meltdown in the gas ring, mounting plates.
13. On coal-fired units, examine the coal grate and any related coal handling equipment (stokers, spreaders, walking beds, etc.) for damage: cracks, fatigue, worn or broken parts. Cycle units to check for proper operation.
14. Inspect fuel air ratio dampers for corrosion, erosion, loose/broken or missing fasteners. Pay particular attention to dampers that are manually set and not normally moved during normal operation.

INSPECTION METHODS • NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: BURNERS (Continued)
CONTROL NUMBER: GSNS 0.08.03.03

INSPECTION ACTIONS

Shutdown Inspection:

15. Check wiring for loose connections, frayed or broken insulation.
16. Check electric controls for worn or pitted contacts, improper safety devices: heaters, fuses.
17. Ensure that related motors, equipment controls are inspected using their respective guide sheets.

Return to Service:

18. Ensure that all tools, equipment, and materials used for inspection have been removed from the unit.
19. Ensure that ail parts, guards, and covers have been reinstalled.
20. Notify affected personnel and obtain permission to place unit back in service.
21. Restore valving to normal position.
22. Remove lockout on disconnect and restore unit to service.
23. Remove tags from all devices.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS ▪ NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: CONDENSATE RETURN TANKS
CONTROL NUMBER: GSNS 0.08.03.04

APPLICATION

This guide applies to all non-standard procedures for all condensate return tanks and related components (fittings, valves, strainers, hangers, insulation, etc.) installed in heating steam and condensate return systems.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out of service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Motors
- Pumps
- Equipment Controls

INSPECTION ACTIONS

Condition Assessment Survey of Heating Subsystems includes visual survey, examination of building records, and analysis. Points include:

Prior to Shutdown:

1. Check vents on unit for excessive vapor discharge, indicating problems with the steam traps or pump controls.
2. Cycle unit controls to effect a complete operation cycle to identify potential malfunctions.

Unit Shutdown:

3. Turn off unit and lock out disconnect.
4. Tag out all electrical devices.
5. Isolate unit mechanically by securing steam and water lines.
6. Tag out all secured valves.

Shutdown Inspection:

7. Thoroughly drain or pump out tank.
8. Remove tank access plates and ventilate interior.
9. Inspect tank interior.
10. Check interior walls for erosion, corrosion, especially in pre-heater area where non-condensabies may collect.
11. Check interior piping for erosion, blockage, loose, broken or missing fasteners.
12. Check internal level controls for damage.
13. Cycle integral pumps. Check for noisy bearings, binding.
14. Inspect pump suction strainers for damage, corrosion, loose, broken or missing fasteners.
15. Check wiring for loose connections, frayed or broken insulation.
16. Check electric controls for worn or pitted contacts, improper safety devices: heaters, fuses.

INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: CONDENSATE RETURN TANKS (Continued)
CONTROL NUMBER: GSNS 0.08.03.04

INSPECTION ACTIONS

Return to Service:

17. Ensure that related pumps, motors, and equipment controls are inspected using their respective guide sheets.
18. Ensure that all tools, equipment, and materials used for inspection have been removed from the unit.
19. Ensure that all parts, guards, and covers have been reinstalled.
20. Notify affected personnel and obtain permission to place unit back in service.
21. Restore valving to normal position.
22. Remove lockout on disconnect and restore unit to service.
23. Remove tags from all devices.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS . NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: DEAERATORS
CONTROL NUMBER: GSNS 0.08.03.05

APPLICATION

This guide applies to all non-standard procedures for deaerators and related components (fittings, valves, strainers, hangers, insulation, etc.) instalied as components in steam distribution and condensate return systems.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out of service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Motors
- Pumps
- Equipment Controls

INSPECTION ACTIONS

Condition Assessment Survey of Heating Subsystems includes visual survey, examination of building records, and analysis. Points include:

Prior to Shutdown:

1. Check vents on unit for excessive vapor discharge indicating problems with the vent condenser or steam injectors.
2. Cycle unit controls to effect a complete operation cycle to identify potential malfunctions.
3. Check steam traps for leakage using sonic detectors.

Unit Shutdown:

4. Turn off unit and lock out disconnect.
5. Tag out all electrical devices.
6. Isolate unit mechanically by securing steam and water lines
7. Tag out all secured valves.

Shutdown Inspection:

8. Thoroughly drain deaerator tank.
9. Remove tank access plates and ventilate interior.
10. Inspect tank interior.
11. Check interior walls for erosion, corrosion, especially in pre-heater area where non-condensables may collect.
12. Check outside of vent condenser for erosion, corrosion, blockage.
13. Check spray nozzles for erosion, corrosion, blockage, loose, broken or missing fasteners, broken or missing tips and springs.
14. Check spray baffles for erosion, corrosion.
15. Check cone for erosion, corrosion, loose, broken, or missing fasteners.

INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: DEAERATORS (Continued)
CONTROL NUMBER: GSNS 0.08.03.05

INSPECTION ACTIONS

Shutdown Inspection:

16. Open and inspect the interior of the vent condenser. Check tubes for corrosion, blockage, leakage.
17. Cycle steam regulating and check valves. Note binding, improper seating.
18. Check wiring for loose connections, frayed or broken insulation.
19. Check electric controls for worn or pitted contacts, improper safety devices: heaters, fuses.
20. Ensure that related pumps, motors, and equipment controls are inspected using their respective guide sheets.

Return to Service:

21. Ensure that all tools, equipment, and materials used for inspection have been removed from the unit.
22. Ensure that all parts, guards, and covers have been reinstalled.
23. Notify affected personnel and obtain permission to place unit back in service.
24. Restore valving to normal position.
25. Remove lockout on disconnect and restore unit to service.
26. Remove tags from all devices.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS ▪ NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: FURNACES
CONTROL NUMBER: GSNS 0.08.03.06

APPLICATION

This guide applies to all non-standard procedures for all furnaces and related components (fittings, valves, strainers, hangers, insulation, etc.) installed as components in a heating hot air distribution system.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out-of-service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Ductwork & Accessories
- Motors
- Fans
- Equipment Controls

INSPECTION ACTIONS

Condition Assessment Survey of Heating Subsystems includes visual survey, examination of building records, and analysis. Points include:

Prior to Shutdown:

1. Perform flue gas analysis.
2. Run unit through a complete operation cycle to identify malfunctioning components.

Unit Shutdown:

3. Power down the unit consistent with department procedure.
4. Isolate and lock out disconnects.
5. Tag out all electrical devices.
6. Isolate unit mechanically by securing steam, fuel, and water lines.
7. Tag out all secured valves.

Shutdown Inspection:

8. Remove access plates and ventilate interior. (Furnace should be thoroughly cleaned prior to inspection.)
9. Inspect access plate. Note cracks, pitting, signs of fatigue, damaged sealing surfaces.
10. Inspect heat exchanger for erosion, corrosion, scale buildup, cracks, metal fatigue, leakage, and blockage.
11. Inspect the combustion chamber(s).
12. Note any refractory defects: missing, cracked, spalling.
13. Check refractory surface for signs of improper fuel flame patterns: not uniform, inadequate throw, sputtering, improper fuel shutoff.
14. Examine flue, bridge walls, and other flow control baffles for erosion, corrosion, heat blisters, buckles, or other distortion.

INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: FURNACES (Continued)
CONTROL NUMBER: GSNS 0.08.03.06

INSPECTION ACTIONS

Shutdown Inspection:

15. inspect the interior of the fuel burner.
16. Note any heating distortion, meltdown in the gas manifold, mounting plates.
17. Check oil burner cone for defects.
18. Inspect breeching/chimney access plates. Note cracks, pitting, distortion; check sealing surfaces for damage.
19. Inspect interior of breeching, chimneys, and stacks.
20. Note excessive corrosion of interior surfaces.
21. Note buildup of soot and other fuel by-products.
22. Check operation of barometric and relief dampers.
23. Record any damage to masonry.
24. Check ductwork for damage, loose or broken fasteners.
25. Cycle all valves (manual and regulating); checking for smooth operation and proper seating.
26. Check wiring for loose connections, frayed or broken insulation.
27. Check electric controls for worn or pitted contacts, improper safety devices: heaters, fuses.
28. Ensure that related fans, motors, burners, equipment controls, etc. are inspected using their respective guide sheets.

Return to Service:

29. Ensure that all tools, equipment, and materials used for inspection have been removed from the unit.
30. Ensure that all parts, guards, and covers have been reinstalled.
31. Notify affected personnel and obtain permission to place unit back in service.
32. Restore valving to normal position.
33. Remove lockout on disconnect and restore unit to service.
34. Remove tags from all devices.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: TERMINAL HEATING UNITS
CONTROL NUMBER: GSNS 0.08.03.07

APPLICATION

This guide applies to all non-standard procedures for all terminal heating and related components (fittings, valves, strainers, hangers, insulation, etc.) installed in the heating distribution system.

SPECIAL INSTRUCTIONS

1. Notify affected personnel and obtain permission to take unit out of service.
2. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Ductwork & Accessories
- Motors

INSPECTION ACTIONS

Condition Assessment Survey of Heating Subsystems includes visual survey, examination of building records, and analysis. Points include:

1. Remove cabinet cover/access plate.
2. Cycle controls to check for smooth response in flow regulators.
3. Turn off unit locally.
4. Isolate unit mechanically by securing air and water lines.
5. Check cabinet and frame for damage, distortion, corrosion.
6. Examine HX for damaged fins, corrosion, leaks.
7. Check fan housing for corrosion, loose fasteners.
8. Check fan blading for damage, distortion.
9. Check fan and motor bearings for excessive play.
10. Check noise control baffles in incoming air duct or frame for corrosion, blockage, loose fasteners.
11. On gas-fired space heaters check flue and flow control baffles for erosion, corrosion, blockage, heat burnout, or distortion.
12. Check wiring for loose connections, frayed or broken insulation.
13. Check electric controls for worn or pitted contacts, improper safety devices: heaters, fuses.
14. Reinstall all parts, guards, and covers.
15. Restore valving to normal position.
16. Notify affected personnel that unit is back in service.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS ▪ NON-STANDARD

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INSPECTION METHODS • NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: ABSORPTION CHILLERS
CONTROL NUMBER: GSNS 0.08.04.01

APPLICATION

This guide applies to all non-standard procedures for all Absorption Chillers and related components (pumps, fittings, valves, strainers, hangers, insulation, etc.) included in HVAC Cooling Systems.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out-of-service.
5. Obtain necessary tools, equipment, and materials

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Pumps
- Cooling Towers

INSPECTION ACTIONS

Condition Assessment Survey of Cooling Subsystems includes visual survey and analysis. Points include:

Prior to Shutdown:

1. Perform leak test on all lines, fittings, and seals.
2. Perform heat balance on chiller. Check against manufacturer's specifications and machine history.

Unit Shutdown:

3. Shut down chiller in accordance with manufacturer's recommendations.
4. Turn off unit and lock out disconnect.
5. Tag out all electrical devices.
6. Isolate unit mechanically by securing fuel and water lines.
7. Tag out all secured valves.

Shutdown Inspection:

8. Drain evaporator, absorber, and condenser HX water sides thoroughly. (Chiller should be thoroughly cleaned prior to inspection.)
9. Remove all access plates (heads) and ventilate interior.
10. Inspect all access plates and seating surfaces for corrosion, pitting, other damage.
11. Inspect tubing interior: use borescope on small coolers.
12. Perform eddy current analysis on tubes.
13. Inspect tube sheets for corrosion, cracks, signs of fatigue, poor expansion.
14. Pull tube bundle (steam generator) and inspect coils for scaling, corrosion, physical damage.
15. Drain/empty burner: fuel-fired units.
16. Check all burner mounting hardware for cracks, loose or broken fasteners. Pay particular attention to welds that may have been fatigued by thermal cycles.

INSPECTION METHODS ▪ NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: ABSORPTION CHILLERS (Continued)
CONTROL NUMBER: GSNS 0.08.04.01

INSPECTION ACTIONS

Shutdown Inspection:

17. On oil-fired units inspect guns for stress cracks, fatigue, signs of overheating, tip damage, and other physical damage.
18. Check oil burner cone for defects.
19. On gas-fired units, note any heating distortion, meltdown in the gas ring, mounting plates.
20. Inspect fuel air ratio dampers for corrosion, erosion; loose, broken, or missing fasteners. Pay particular attention to dampers that are manually set and not normally moved during normal operation.
21. Pull and inspect temperature sensors. Check for corrosion, scaling, physical damage.
22. Inspect temperature wells for damage, corrosion.
23. Check wiring for loose connections, frayed or broken insulation.
24. Check electric controls for worn or pitted contacts, improper safety devices: heaters, fuses.

Return to Operation:

25. Ensure that all tools, equipment, and materials used for inspection have been removed from the unit.
26. Ensure that all parts, guards, and covers have been reinstalled (new seals should be used).
27. Notify affected personnel and obtain permission to place unit back in service.
28. Restore valving to normal position.
29. Remove lockout on disconnect and restore unit to service.
30. Remove tags from all devices.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS . NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: CENTRIFUGAL COMPRESSORS
CONTROL NUMBER: GSNS 0.08.04.02

APPLICATION

This guide applies to all non-standard procedures for all centrifugal refrigeration compressors and related components (fittings, integral pumps, valves, strainers, insulation, etc.) installed as components in Cooling Chiller Systems.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out-of-service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Motors
- Pipes & Accessories
- Condensers
- Liquid Coolers

INSPECTION ACTIONS

Condition Assessment Survey of Cooling Subsystems includes visual survey, examination of building records, and analysis. Points include:

Prior to Shutdown:

1. Verify load on unit.
2. Move load controller set point to obtain maximum load.
3. Monitor pressure and temperature gauges and compare against rating data.
4. Move load controller set point to obtain minimum load.
6. Monitor pressure and temperature gauges and compare against rating data.
7. Perform vibration analysis on compressor at maximum, minimum, and 50% load.

Unit Shutdown:

8. Turn off unit and lock out disconnect.
9. Tag out all electrical devices.
10. Isolate unit mechanically by securing valves on associated components.
11. Tag out all secured valves.

Shutdown Inspection:

12. Draw sample from oil reservoir. Send to laboratory for wear analysis.
13. Test unit for leaks at shaft seals (external drives only) and vane shaft.
14. Pull and inspect oil pump.
15. Check oil pump gears for excessive or uneven wear.
16. Check magnetic strainer for indications of ferrous wear products.
17. Check exposed drive shafting for cracks, fatigue, and corrosion. Check suspicious areas with dye penetrant.

INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: CENTRIFUGAL COMPRESSORS (Continued)
CONTROL NUMBER: GSNS 0.08.04.02

INSPECTION ACTIONS

Shutdown Inspection:

18. Check drive shaft bearing thrust and run-out clearances (compare with manufacturer's specification and machine history).
19. Open and inspect drive reducer. Check gears for excessive or uneven wear.
20. Check gears for cracks, fatigue and corrosion. Check suspicious areas with dye penetrant.
21. Check coupling for wear, damage, loose fasteners.
22. Check coupling for misalignment.

Return to Operation:

23. Close all casings. Ensure new seals are employed.
24. Ensure that all tools, equipment, and materials used for inspection have been removed from the unit.
25. Ensure that all guards and covers have been reinstalled.
26. Notify affected personnel and obtain permission to place unit back in service.
27. Restore valving to normal position.
28. Perform leak check on system.
29. Remove lockout on disconnect and restore unit to service.
30. Remove tags from all devices.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS . NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: CONDENSERS
CONTROL NUMBER: GSNS 0.08.04.03

APPLICATION

This guide applies to all non-standard procedures for all refrigerant condensers (shell and tube, air-cooled, and evaporative) and related components (piping, fittings, valves, fans, motors, etc.) installed in Cooling System Chiller Plants.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installers instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out-of-service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Liquid Coolers
- Compressors

INSPECTION ACTIONS

Condition Assessment Survey of Cooling Subsystems includes visual survey, examination of building records, and analysis. Points include:

Prior to Shutdown:

1. Perform leak test on all refrigerant fittings and seals.
2. Perform heat balance on condenser. Check against manufacturer's specifications and machine history.

Unit Shutdown:

3. Turn off unit and lock out disconnect.
4. Tag out all electrical devices.
5. Isolate unit mechanically by securing fuel and water lines.
6. Tag out all secured valves.

Shutdown Inspection:

7. Drain condenser water side thoroughly (condenser should be thoroughly cleaned prior to inspection).
8. Remove access plates (heads) and ventilate interior.
9. Inspect access plates and seating surfaces for corrosion, pitting, other damage.
10. Inspect tubing interior (shell and tube units - use borescope on small coolers).
11. Perform eddy current analysis on tubes (shell and tube units).
12. Inspect tube sheets (shell and tube units) for corrosion, cracks, signs of fatigue, poor expansion.
13. Inspect tubes and fins (evaporative condensers) for corrosion, cracks, signs of fatigue, damaged or missing fins.
14. Perform leak test of tubes and tube sheet joints.
15. Check interior (evaporative condensers) housing, basin for corrosion, loose or missing fasteners.

INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: CONDENSERS (Continued)
CONTROL NUMBER: GSNS 0.08.04.03

INSPECTION ACTIONS

Shutdown Inspection:

16. Check level control assembly (evaporative condensers) for corrosion, loose or missing fasteners, physical damage.
17. Check spray pump assembly (evaporative condensers) for corrosion, loose or missing fasteners, physical damage.
18. Check nozzles and diffusers (evaporative condensers) for corrosion, loose or missing fasteners, physical damage.
19. Check fan assembly (evaporative condensers) for corrosion, loose or missing fasteners, physical damage.
20. Pull and inspect temperature sensors. Check for corrosion, scaling, physical damage.
21. Inspect temperature wells for damage, corrosion.
22. Check wiring for loose connections, frayed or broken insulation.
23. Check electric controls for worn or pitted contacts, improper safety devices (heaters, fuses).

Return to Operation:

24. Open and inspect purge unit (compressor, float assembly, condenser). Check for worn, damaged parts.
25. Ensure that all tools, equipment, and materials used for inspection have been removed from the unit.
26. Ensure that all parts, guards, and covers have been reinstalled (new seals should be used).
27. Notify affected personnel and obtain permission to place unit back in service.
28. Restore valving to normal position.
29. Remove lockout on disconnect and restore unit to service.
30. Remove tags from all devices.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: CONDENSING UNITS
CONTROL NUMBER: GSNS 0.08.04.04

APPLICATION

This guide applies to all non-standard procedures for all refrigerant condensing units and related components (fittings valves, strainers, hangers, insulation, etc.) installed as part of an HVAC Cooling system.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installers instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out of service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Liquid Coolers
- Air Handlers

INSPECTION ACTIONS

Condition Assessment Survey of Cooling Subsystems includes visual survey, examination of building records, and analysis. Points include:

Prior to Shutdown:

1. Perform leak test on all refrigerant fittings and seals.
2. Cycle unit controls to effect a complete operation cycle to identify potential malfunctions.

Unit Shutdown:

3. Turn off unit and lock out disconnect.
4. Tag out all electrical devices.
5. Isolate unit mechanically by securing steam and water lines.
6. Tag out all secured valves.

Shutdown Inspection:

7. Remove access plates and ventilate interior.
8. Check access plates for signs of leakage.
9. Inspect enclosure for cracks, corrosion, other physical damage.
10. Check finned tube condenser (air-cooled) for leakage, corrosion, bent or missing fins.
11. Inspect tubing interior (shell and tube units - use borescope on small coolers).
12. Perform eddy current analysis on tubes (shell and tube units).
13. Inspect tube sheets (shell and tube units) for corrosion, cracks, signs of fatigue, poor expansion of tubes.
14. Inspect condenser fan assembly (air-cooled) for corrosion, loose or missing fasteners, other physical damage (worn sheaves).
15. Inspect condenser shell (water-cooled) exterior for leakage, stress cracks, corrosion, other physical damage.
16. Check compressors for corrosion, vibration, leakage, damaged mounts.
17. Check compressor drive for gross misalignment.

INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: CONDENSING UNITS (Continued)
CONTROL NUMBER: GSNS 0.08.04.04

INSPECTION ACTIONS

Shutdown Inspection:

18. Note any inoperative motor starters.
19. Check conduit, control housings, and panels for corrosion, leakage.
20. Check wiring for loose connections, frayed or broken insulation.
21. Check electric controls for worn or pitted contacts, improper safety devices (heaters, fuses).

Return to Service:

22. Ensure that all tools, equipment, and materials used for inspection have been removed from the unit.
23. Ensure that all parts, guards, and covers have been reinstalled.
24. Notify affected personnel and obtain permission to place unit back in service.
25. Restore valving to normal position.
26. Remove lockout on disconnect and restore unit to service.
27. Remove tags from all devices.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: COOLING TOWERS
CONTROL NUMBER: GSNS 0.08.04.05

APPLICATION

This guide applies to all non-standard procedures for cooling towers and related components (fittings, valves, strainers, hangers, insulation, etc.) installed in HVAC Cooling Service and Distribution Systems.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out-of-service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Pumps
- Condensers

INSPECTION ACTIONS

Condition Assessment Survey of Cooling Subsystems includes visual survey, examination of building records, and analysis. Points include:

Prior to Shutdown:

1. Run unit through a complete operation cycle to identify malfunctioning components.

Unit Shutdown:

2. Power down the unit consistent with department procedure.
3. Isolate and lock out disconnects.
4. Tag out all electrical devices.
5. Isolate unit mechanically by securing water lines.
6. Tag out all secured valves.

Shutdown Inspection:

7. Drain tower thoroughly.
8. Remove access plates (tower should be thoroughly cleaned prior to inspection).
9. Inspect access plates. Note cracks, pitting, defective seals.
10. Check tower interior for corrosion, scale buildup.
11. Check screens, louvers, fill, and eliminators for erosion, corrosion, loose or broken fasteners.
12. Inspect fan assembly for loose or missing fasteners, blading distortion, imbalance.
13. Inspect drive reducer for loose or missing fasteners, leakage, worn gears.
14. Inspect drive shaft for loose or missing fasteners, worn bearings.
15. Check belt sheaves for wear, damage.
16. Inspect basin heating elements. Check for scaling, open elements.
17. Cycle all valves (manual and regulating). Check for smooth operation and positive seating.
18. Check wiring for loose connections, frayed or broken insulation.
19. Check electric controls for worn or pitted contacts, improper safety devices (heaters, fuses).

INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: COOLING TOWERS (Continued)
CONTROL NUMBER: GSNS 0.08.04.05

INSPECTION ACTIONS

Return to Service:

20. Ensure that all tools, equipment, and materials used for inspection have been removed from the unit.
21. Ensure that all parts, guards, and covers have been reinstalled.
22. Notify affected personnel and obtain permission to place unit back in service.
23. Restore valving to normal position.
24. Remove lockout on disconnect and restore unit to service.
25. Remove tags from all devices.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS . NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: LIQUID COOLERS
CONTROL NUMBER: GSNS 0.08.04.06

APPLICATION

This guide applies to all non-standard procedures for all liquid coolers (evaporators for chilled water) and related components (piping, fittings, valves, insulation, etc.) installed in Cooling System Chiller Plants.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out-of-service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Condensers
- Compressors

INSPECTION ACTIONS

Condition Assessment Survey of Cooling Subsystems includes visual survey, examination of building records, and analysis. Points include:

Prior to Shutdown:

1. Perform heat balance on cooler. Check against manufacturer's specifications and machine history.

Unit Shutdown:

2. Turn off unit and lock out disconnect.
3. Tag out all electrical devices.
4. Isolate unit mechanically by securing fuel and water lines.
5. Tag out all secured valves.

Shutdown Inspection:

6. Drain cooler water, side thoroughly (cooler should be thoroughly cleaned prior to inspection).
7. Remove access plates (heads) and ventilate interior.
8. Inspect access plates and seating surfaces for corrosion, pitting, other damage.
9. Inspect tubing interior (use borescope on small coolers).
10. Perform eddy current analysis on tubes.
11. Inspect tube sheets for corrosion, cracks, signs of fatigue, poor expansion of tubes.
12. Perform leak test of tubes and tube sheet joints.
13. Pull and inspect temperature sensors. Check for corrosion, scaling, physical damage.
14. Inspect temperature wells for damage, corrosion.
15. Check wiring for loose connections, frayed or broken insulation.
16. Check electric controls for worn or pitted contacts, improper safety devices (heaters, fuses).

INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: LIQUID COOLERS (Continued)
CONTROL NUMBER: GSNS 0.08.04.06

INSPECTION ACTIONS

Return to Ooeration:

17. Ensure that all tools, equipment, and materiais used for inspection have been removed from the unit.
18. Ensure that all parts, guards, and covers have been reinstalled (new seals should be used).
19. Notify affected personnel and obtain permission to place unit back in service.
20. Restore valving to normal position.
21. Remove lockout on disconnect and restore unit to service.
22. Remove tags from all devices.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS . NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: PACKAGED CHILLERS
CONTROL NUMBER: GSNS 0.08.04.07

APPLICATION

This guide applies to all non-standard procedures for all packaged chilling units and related components (fittings, valves, strainers, hangers, insulation, etc.) installed as part of an HVAC Cooling Chilled Water System.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out-of-service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Motors
- Pumps

INSPECTION ACTIONS

Condition Assessment Survey of Cooling Subsystems includes visual survey, examination of building records, and analysis. Points include:

Prior to Shutdown:

1. Perform leak test on all refrigerant fittings and seals.
2. Cycle unit controls to effect a complete operation cycle to identify potential malfunctions.

Unit Shutdown:

3. Turn off unit and lock out disconnect.
4. Tag out all electrical devices.
5. Isolate unit mechanically by securing steam and water lines.
6. Tag out all secured valves.

Shutdown Inspection:

7. Remove access plates and ventilate interior.
8. Check access plates for signs of leakage.
9. Inspect enclosure for cracks, corrosion, other physical damage.
10. Check finned tube condenser (air-cooled) for leakage, corrosion, bent or missing fins.
11. Inspect condenser fan assembly (air-cooled) or corrosion, loose or missing fasteners, other physical damage.
12. Inspect condenser shell (water-cooled) exterior for leakage, stress cracks, corrosion, other physical damage.
13. Inspect tubing interior (shell and tube units). Use borescope on small coolers).
14. Perform eddy current analysis on tubes (shell and tube units).
15. Inspect tube sheets (shell and tube units) for corrosion, cracks, signs of fatigue, poor expansion of tubes.
16. Inspect evaporator shell exterior for leakage, stress cracks, corrosion, other physical damage.
17. Check compressors for corrosion, vibration, leakage, damaged mounts.

INSPECTION METHODS ▪ NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: PACKAGED CHILLERS (Continued)
CONTROL NUMBER: GSNS 0.08.04.07

INSPECTION ACTIONS

Shutdown Inspection:

18. Check compressor drive for gross misalignment (open drive units).
19. Note any inoperative motor starters.
20. Check conduit, control housings, and panels for corrosion, leakage.
21. Check wiring for loose connections, frayed, or broken insulation.
22. Check electric controls for worn or pitted contacts, improper safety devices (heaters, fuses).

Return to Service:

23. Ensure that all tools, equipment, and materials used for inspection have been removed from the unit.
24. Ensure that all parts, guards, and covers have been reinstalled.
25. Notify affected personnel and obtain permission to place unit back in service.
26. Restore valving to normal position.
27. Remove lockout on disconnect and restore unit to service.
28. Remove tags from all devices.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: RECIPROCATING COMPRESSORS
CONTROL NUMBER: GSNS 0.08.04.08

APPLICATION

This guide applies to all non-standard procedures for all reciprocating refrigeration compressors and related components (fittings, integral pumps, valves, strainers, heaters, etc.) installed as components in Cooling Chiller, Packaged HVAC and Condensing Unit Systems.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out-of-service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Motors
- Pipes & Accessories
- Condensers
- Liquid Coolers

INSPECTION ACTIONS

Condition Assessment Survey of Cooling Subsystems includes visual survey, examination of building records, and analysis. Points include:

Prior to Shutdown:

1. Verify load on unit.
2. Move load controller set point to obtain maximum load.
3. Monitor pressure and temperature gauges and compare against rating data.
4. Move load controller set point to obtain minimum load. (Verify unloader operation.)
5. Monitor pressure and temperature gauges and compare against rating data.
6. Perform vibration analysis on compressor at maximum, minimum, and 50% load.

Unit Shutdown:

7. Pump down unit.
8. Turn off unit and lock out disconnect.
9. Tag out all electrical devices.
10. Isolate unit mechanically by securing suction and discharge valves.
11. Tag out all secured valves.

Shutdown Inspection:

12. Test unit for leaks at shaft seals (external drives only).
13. Draw sample from oil reservoir: send to laboratory for wear analysis.
14. Check magnetic strainer for indications of ferrous wear products.
15. Check exposed drive shafting for cracks, fatigue and corrosion. Check suspicious areas with dye penetrant.
16. Check drive shaft bearing thrust and run-out clearances (compare with manufacturer's specification and machine history).

INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: RECIPROCATING COMPRESSORS (Continued)
CONTROL NUMBER: GSNS 0.08.04.08

INSPECTION ACTIONS

Shutdown Inspection:

17. Check coupling for wear, damage, loose fasteners.
18. Check coupling for misalignment.

Return to Operation:

19. Ensure that all tools, equipment, and materials used for inspection have been removed from the unit.
20. Ensure that all guards and covers have been reinstalled.
21. Notify affected personnel and obtain permission to place unit back in service.
22. Restore valving to normal position.
23. Remove lockout on disconnect and restore unit to service.
24. Remove tags from all devices.
25. Verify crankcase heater operation.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: TERMINAL COOLING UNITS
CONTROL NUMBER: GSNS 0.08.04.09

APPLICATION

This guide applies to all non-standard procedures for all terminal Cooling units and related components (fittings, valves, strainers, hangers, insulation, etc.) installed in the HVAC Cool Air Distribution System.

SPECIAL INSTRUCTIONS

1. Notify affected personnel and obtain permission to take unit out-of-service.
2. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Ductwork & Accessories

INSPECTION ACTIONS

Condition Assessment Survey of Cooling Subsystems includes visual survey, examination of building records, and analysis. Points include:

1. Remove cabinet cover/access plate.
2. Cycle controls to check for smooth response in flow regulators.
3. Turn off unit locally.
4. Isolate unit mechanically by securing air and water lines.
5. Check cabinet and frame for damage, distortion, corrosion.
6. Examine HX for damaged fins, corrosion, leaks.
7. Check fan housing for corrosion, loose fasteners.
8. Check fan blading for damage, distortion.
9. Check fan and motor bearings for excessive play.
10. Check belt sheaves for wear and damage.
11. Check dampers' noise control baffles in incoming air duct or frame for corrosion, blockage, loose fasteners.
12. Check interior for damaged or missing insulation.
13. Check wiring for loose connections, frayed or broken insulation.
14. Check electric controls for worn or pitted contacts, improper safety devices (heaters, fuses).
15. Reinstall all parts, guards, and covers.
16. Restore valving to normal position.
17. Notify affected personnel that unit is back in service.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS . NON-STANDARD

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INSPECTION METHODS ▪ NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: AIR HANDLERS
CONTROL NUMBER: GSNS 0.08.05.01

APPLICATION

This guide applies to all non-standard procedures for all air handlers/heating and ventilating units and related components (air cleaners, dampers, HX coils, fittings, valves, strainers, hangers, insulation, etc.) in HVAC air distribution systems.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out of service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Ductwork & Accessories
- Motors
- Equipment Controls

INSPECTION ACTIONS

Condition Assessment Survey of Heating Subsystems includes visual survey, examination of building records, and analysis. Points include:

Prior to Shutdown:

1. Measure effective delivery of air handler in CFM.
2. Run unit through a complete operation cycle to check for potential malfunctions.
3. Check steam traps for leakage using sonic detectors.
4. Check fan RPM with tachometer or stroboscope (compare with specifications).
5. Perform vibration analysis on the fan.

Unit Shutdown:

6. Turn off unit and lock out disconnect.
7. Tag out all electrical devices.
8. Isolate unit mechanically by securing steam and water lines.
9. Tag out all secured valves.

Shutdown Inspection:

10. Inspect fan assemblies.
11. Check fan blading for erosion, corrosion, distortion, broken welds or fasteners.
12. Check fan shafting for distortion.
13. Check fan shaft play in bearings.
14. Check fan interior housing for erosion, corrosion.
15. Check fan pulleys for wear/damage.
16. Examine eliminators for corrosion, missing baffles, loose or broken fasteners.
17. Examine damper actuators. Check for worn, distorted shafting or linkage. Note leakage of pneumatic operators and relays.

INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: AIR HANDLERS (Continued)
CONTROL NUMBER: GSNS 0.08.05.01

INSPECTION ACTIONS

Shutdown Inspection:

18. Check humidifier, drain pans, and piping for corrosion.
19. Check humidifier nozzles for corrosion or blockage.
20. Inspect electric heating coils for erosion, corrosion, physical damage.
21. Check electric heating element resistance and ground.
22. Check for missing or damaged insulation.
23. Check wiring for loose connections, frayed or broken insulation.
24. Check electric controls for worn or pitted contacts, improper safety devices (heaters, fuses).
25. Ensure that related motors and equipment controls are inspected using their respective guide sheets.

Return to Service:

26. Ensure that all tools, equipment, and materials used for inspection have been removed from the unit.
27. Ensure that all parts, guards, and covers have been reinstalled.
28. Notify affected personnel and obtain permission to place unit back in service.
29. Restore valving to normal position.
30. Remove lockout on disconnect and restore unit to service.
31. Remove tags from all devices.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS - **NON-STANDARD**

GUIDE SHEET

SYSTEM/COMPONENT: DUCTWORK &ACCESSORIES
CONTROL NUMBER: GSNS 0.08.05.02

APPLICATION .

This guide applies to all non-standard procedures for all ductwork and related components (fittings, valves, strainers, hangers, insulation, etc.) installed for HVAC ventilation system.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out of service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:
- Fans
- Air Handler Units

INSPECTION ACTIONS

Condition Assessment Survey of HVAC Subsystems includes visual survey, examination of building records, and analysis. Points include:

Unit Shutdown:

1. Turn off related air handlers and fans.
2. Tag out all electrical devices.

Shutdown Inspection:

3. Inspect duct interior.
4. Check interior walls for erosion, corrosion.
5. Check interior insulation. Note wetness, damage, missing sections.
6. Check for condensation ponding.
7. Examine turning vanes and dampers for corrosion, loose or broken fasteners.
8. Check damper operators for damaged linkage, leaking actuators
9. Check that fire dampers are open and fusible links are properly set.
10. Examine interior of VAV boxes.
11. Check for damage to VAV dampers: corrosion, distortion, improper seals.
12. Check VAV HX coils for damage: leaks, bent fins.
13. Check VAV circulating fans for damage, loose fasteners.
14. Check wiring for loose connections, frayed or broken insulation.
15. Check electric controls for worn or pitted contacts, improper safety devices (heaters, fuses).

Return to Service:

16. Ensure that all tools, equipment, and materials used for inspection have been removed from the unit.
17. Ensure that all parts, guards, and covers have been reinstalled.
18. Notify affected personnel and obtain permission to place unit back in service.
19. Remove lockout on disconnect and restore unit to service.
20. Remove tags from all devices.

INSPECTION METHODS ▪ NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: DUCTWORK &ACCESSORIES (Continued)
CONTROL NUMBER: GSNS 0.08.05.02

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS ▪ NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: FANS
CONTROL NUMBER: GSNS 0.08.05.03

APPLICATION

This guide applies to all non-standard procedures for all stand-alone fans and related components (fittings, valves, strainers, hangers, insulation, etc.) installed in the HVAC ventilating system, boilers, and furnaces (does not include fans installed in air handlers and heating and ventilating units).

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out of service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Ductwork & Accessories
- Motors
- Equipment Controls

INSPECTION ACTIONS

Condition Assessment Survey of Heating Subsystems includes visual survey, examination of building records, and analysis. Points include:

Prior to Shutdown:

1. Measure effective delivery of fan in CFM.
2. Run unit through a complete operation cycle to check for potential malfunctions.
3. Check fan RPM with tachometer or stroboscope (compare with specifications).

Unit Shutdown:

5. Turn off unit and lock out disconnect.
6. Tag out all electrical devices.

Shutdown Inspection:

7. Inspect fan assemblies.
8. Check fan blading for erosion, corrosion, distortion, broken welds or fasteners.
9. Check fan shafting for distortion.
10. Check fan shaft play in bearings.
11. Check fan interior housing for erosion, corrosion.
12. Check fan pulleys for wear/damage.
13. Examine damper actuators. Check for worn, distorted shafting or linkage. Note leakage of pneumatic operators and relays.
14. Check wiring for loose connections, frayed or broken insulation.
15. Check electric controls for worn or pitted contacts, improper safety devices (heaters, fuses).
16. Ensure that related motors and equipment controls are inspected using their respective guide sheets.

INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: FANS (Continued)
CONTROL NUMBER: GSNS 0.08.05.03

INSPECTION ACTIONS

Return to Service:

17. Ensure that all tools, equipment, and materials used for inspection have been removed from the unit.
18. Ensure that all parts, guards, and covers have been reinstalled.
19. Notify affected personnel and obtain permission to place unit back in service.
20. Remove lockout on disconnect and restore unit to service.
21. Remove tags from all devices.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: PACKAGED HVAC UNITS
CONTROL NUMBER: GSNS 0.08.05.04

APPLICATION

This guide applies to all non-standard procedures for all packaged HVAC units and related components (fittings, valves, strainers, hangers, insulation, etc.) installed as part of a Cooling System.

SPECIAL INSTRUCTIONS

1. Review mechanical and electrical plans to determine systems and areas affected by equipment/system outage.
2. Review manufacturer's or installer's instructions.
3. Inspection should be scheduled when system is not in use.
4. Notify affected personnel and obtain permission to take unit out-of-service.
5. Obtain necessary tools, equipment, and materials.

CONCURRENT ACTIONS

Inspect associated:

- Pipes & Accessories
- Ductwork & Accessories
- Cooling Towers

INSPECTION ACTIONS

Condition Assessment Survey of Cooling Subsystems includes visual survey, examination of building records, and analysis. Points include:

Prior to Shutdown:

1. Perform leak test on all refrigerant fittings and seals.
2. Cycle unit controls to effect a complete operation cycle to identify potential malfunctions.

Unit Shutdown:

3. Turn off unit and lock out disconnect.
4. Tag out all electrical devices.
5. Isolate unit mechanically by securing steam and water lines.
6. Tag out all secured valves.

Shutdown Inspection:

7. Remove access plates and ventilate interior.
8. Check access plates for signs of leakage.
9. Inspect enclosure for cracks, corrosion, other physical damage.
10. Check finned tube condenser (air-cooled) for leakage, corrosion, bent or missing fins.
11. Inspect condenser fan assembly (air-cooled) for corrosion, loose or missing fasteners, other physical damage.
12. Inspect condenser shell (water-cooled) exterior for leakage, stress cracks, corrosion, other physical damage.
13. Check finned tube evaporator for leakage, corrosion, bent or missing fins.
14. Inspect evaporator fan assembly for corrosion, loose or missing fasteners, other physical damage.
15. Check evaporator compartment insulation for loose/missing sections, damage, wetness.
16. Check compressors for corrosion, vibration, leakage, damaged mounts.
17. Check compressor drive for gross misalignment.

INSPECTION METHODS - NON-STANDARD

GUIDE SHEET

SYSTEM/COMPONENT: PACKAGED HVAC UNITS (Continued)
CONTROL NUMBER: GSNS 0.08.05.04

INSPECTION ACTIONS

Shutdown Inspection:

18. Inspect duct heating elements for corrosion, loose fasteners, open elements (electric units).
19. Inspect furnace casing for stress cracks, corrosion, other physical damage.
20. Check combustion fan housings for corrosion, leakage, damage.
21. Note any damage in air flow dampers and linkage.
22. Examine exposed parts of air cleaner, humidifier, etc. for any signs of leakage, damage, loose or missing fasteners.
23. Note any inoperative motor starters.
24. Check conduit, control housings, and panels for corrosion, leakage.
25. Check wiring for loose connections, frayed or broken insulation.
26. Check electric controls for worn or pitted contacts, improper safety devices (heaters, fuses).

Return to Service:

27. Ensure that all tools, equipment, and materials used for inspection have been removed from the unit.
28. Ensure that all parts, guards, and covers have been reinstalled.
29. Notify affected personnel and obtain permission to place unit back in service.
30. Restore valving to normal position.
31. Remove lockout on disconnect and restore unit to service.
32. Remove tags from all devices.

TOOLS & MATERIALS

1. Non-Standard Inspection Tools - Mechanical
2. As required for the test being performed.

END OF SUBSECTION

DATA COLLECTION METHODS

GENERAL

The heart of the CAS System is built around the hand-held data collection device and the CAIS software that supports it. As discussed in the Introduction, this is a "new way" of seeing and recording specific standardized information. Several phases are involved in the CAS inspection process. They include:

PHASE I — PRESURVEY

- Facility managers review assets and assign each an Asset Determinant Factor (ADF) to define the level and type of inspection to be accomplished (see Subsection 1.1 for definition).
- Facility managers assign specific assets to CAS inspectors.
- The CAS Inspector reviews existing asset data (including as-builts and past repair reports) and the Work Breakdown Structure (WBS) systems requiring inspection, which are then subdivided as necessary. (For example, a large roof may be subdivided into four (4) WBS items such as North, South, East and West sections.)
- The inspector establishes the Inspection Units (IU) to be surveyed based on the WBS (or multiple WBS). IUs may also be added in the field.
- Facility manager and/or staff downloads asset data into the hand-held data collection device.

PHASE 2 — SURVM

- Conduct CAS inspection.
- Upload data into PC-based CAIS.
- Review raw data "universal" reports.

PHASE 3 — POSTSURVEY

- Correct data, as necessary, issue final "universal" report, and create other required reports for facility managers.
- Data and reports are created and issued through DOE hierarchy (see Introduction).

DATA COLLECTION METHODS

ENTERING DATA: DATA COLLECTION MENU

SURVEY STEP: **LOGIN** SCREEN 1.0

The screen contains identification data including the inspector's name, ID number, and discipline to be inspected. This data may be input or preloaded. From this screen, several information and help pop-up aids can be accessed. Help functions would provide screen-specific instructions, and information functions would list special management instructions and/or schedules specifically for the inspector.

SURVEY STEP: ASSET IDENTIFICATION SCREEN 2.0

Asset identification including class, type, ADF number (see subsection 1.1 for ADF description), and asset ID numbers are captured on this screen. Pop-up screens with preformatted picklists (for type and class) are provided for the inspector's review and selection. Additional support screens include ASSET DIMENSIONS indicating key elements required for inspection (such as asset gross square footage, perimeter, height, etc.); and ASSET DESCRIPTION for recording asset name and address. Such information would be entered (or verified) by the inspector prior to the actual asset CAS inspection.

SURVEY STEP: WBS SELECTION SCREEN 3.0

This screen displays the preselected systems and WBS listings based on the ADF selected for the particular asset. Although all WBS assemblies for a system will be listed, the inspector selects only assemblies applicable to the specific asset. For example, although all system 0.05 Roof WBS categories are listed, the inspector would eliminate all non-applicable categories by "de-selecting" non-applicable items. Once this process is complete, the inspector can re-sort the included WBS items. Columns are also provided that indicate the survey status for each WBS item.

At this point, the inspector can subdivide the WBS. For example, the inspector may elect to split a large roof into four sections, each as a separate WBS, or isolate a pump from a WBS containing several pumps. This feature will allow the inspector to logically build his survey based on the unique properties and requirements of each asset.

Finally, while most WBS structuring will be accomplished prior to the CAS inspection, WBS subdivision can also be done in the field.

DATA COLLECTION METHODS

ENTERING DATA: DATA COLLECTION MENU (Continued)

SURVEY STEP: INSPECTION UNIT (IU) SELECTION SCREEN 4.0

While screen 3.0 defines the WBS structure, screen 4.0 concerns selecting the IU for each WBS category. In the CAIS software, the base CAS (see subsection 1.1 for definition) is preset at the assembly level for all systems. For example, a WBS Roof System, Built-up Membrane Roofing (0.05.01), is set at the assembly level. At this point the inspector would select the type of assembly based on a preselected picklist. (Such a picklist at the assembly level might include various roof assembly groupings; eg., 3 to 5-ply asphalt with gravel coating and composite insulation.) If a more detailed inspection is required, the inspector would "de-select" the base CAS assembly level by crossing through the LVL Box "Assy." This action would bring up the next level "component." In our roof example, this would mean that the inspector would now assess the membrane, flashing, and insulation as separate components. As with the assembly level, the inspector would choose a type from a selected picklist for each component. Although IUs are usually determined prior to the survey, multiple IUs may also be developed during the inspection. For example, a WBS of the south quadrant built-up roof may be divided into two IUs (eg., sw corner and remaining roof) if the inspector chooses to highlight and isolate some abnormal conditions from the main IU.

Additional information developed on this screen would include the percentage of WBS served by the IU, the estimated quantity (this figure will also be independently generated by CAIS status (see subsection 1.1), estimated life remaining useful without repair (WOR), and estimated age.

SURVEY STEP: DEFICIENCY ASSESSMENT SCREEN 4.1

With the WBS and IU established, the inspector now conducts the CAS inspection for each WBS IU. As the inspector surveys the asset, a preformatted picklist containing all deficiencies that may affect the particular WBS IU is reviewed. The default setting shows a zero in each coverage block, indicating no deficiencies. As the survey proceeds, the inspector "de-selects" this normal setting by entering a percentage of coverage under condition categories listed (light, moderate, severe, and fail). For example, inspector entries for WBS roofing, IU built-up membrane, deficiency "splitting" of 10% light, 0% moderate, 0% severe, 0% fail, would be interpreted by CAIS software as 90% normal, and light splitting occurring over 10% of the membrane. If the inspector cannot determine the condition using standard inspection methods, he can indicate the need for a non-standard inspection (NSIP) by de-selecting the "NO" in the NSIP column. To complete the inspection, the aforementioned procedures would be carried out for each deficiency noted by the inspector.

DATA COLLECTION METHODS

ENTERING DATA: DATA COLLECTION MENU (Continued)

SURVEY STEP: SUMMARY CONDITION ASSESSMENT SCREEN 5.0

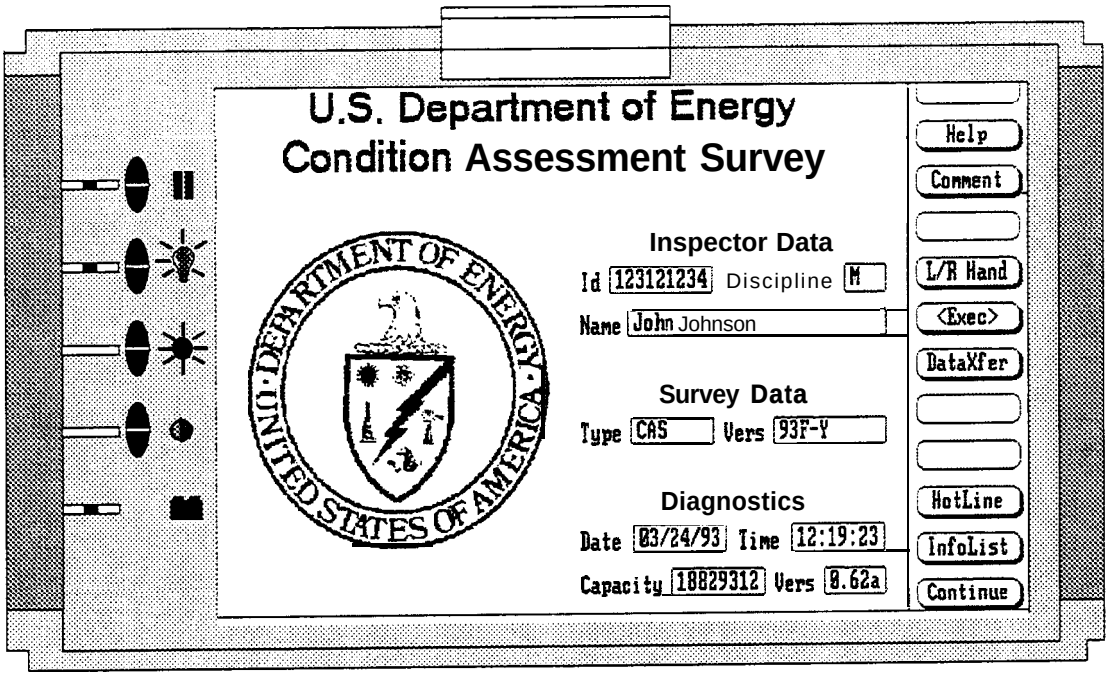
This final screen summarizes the WBS IU in three major categories: urgency, purpose, and condition. In each category, the inspector will call up a picklist and select the category he feels is most appropriate for the WBS IU surveyed. (For the purpose category, the inspector may select multiple headings.) Additionally, the inspector may elect to enter an estimated cost and/or quantity. (This is optional as CAIS will generate these data based on the inspector's survey information.) The inspector will also enter an estimated remaining life post-repair. As an option, a work order may be generated based on the CAS survey information. This option is generated by selecting the WORK ORDER function key and filling out pertinent data. Finally, the inspector may choose to describe the repair more fully by selecting the REPAIR CHARACTER key.

After completing all WBS IUs, the CAS inspection for the system is complete. This procedure is repeated for each applicable system. Once all systems for the asset are complete, the information is uploaded to the PC-based CAIS program for data analysis and report generation.

In the remainder of this subsection, actual data screens, as they will appear to the inspector, are displayed to illustrate a typical inspection. As previously noted, five main screens are used in the system supported by numerous "pop-up" lists, information, comment, and other auxiliary screens. In our examples, main screens are numbered 1.0 - 5.0; secondary screens are labeled 1.1, 1.2, etc.; and general support screens use the series 99.0. Key inspector actions on each screen are highlighted. Support function keys are listed below these main functions.

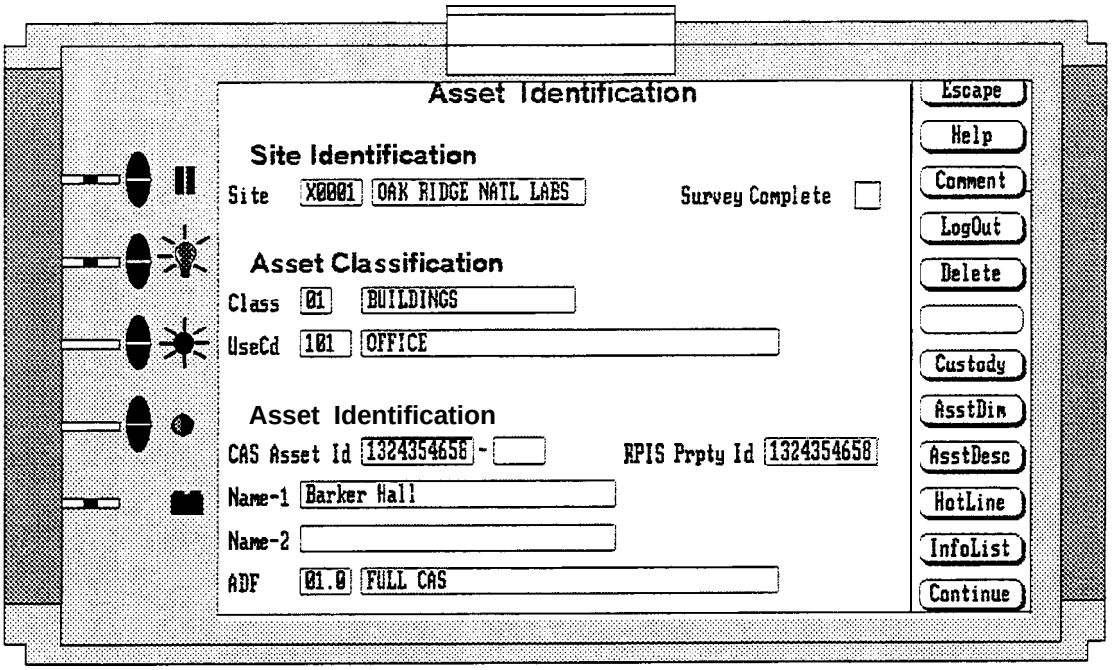
SURVEY STEP LOGIN

Screen 1.0



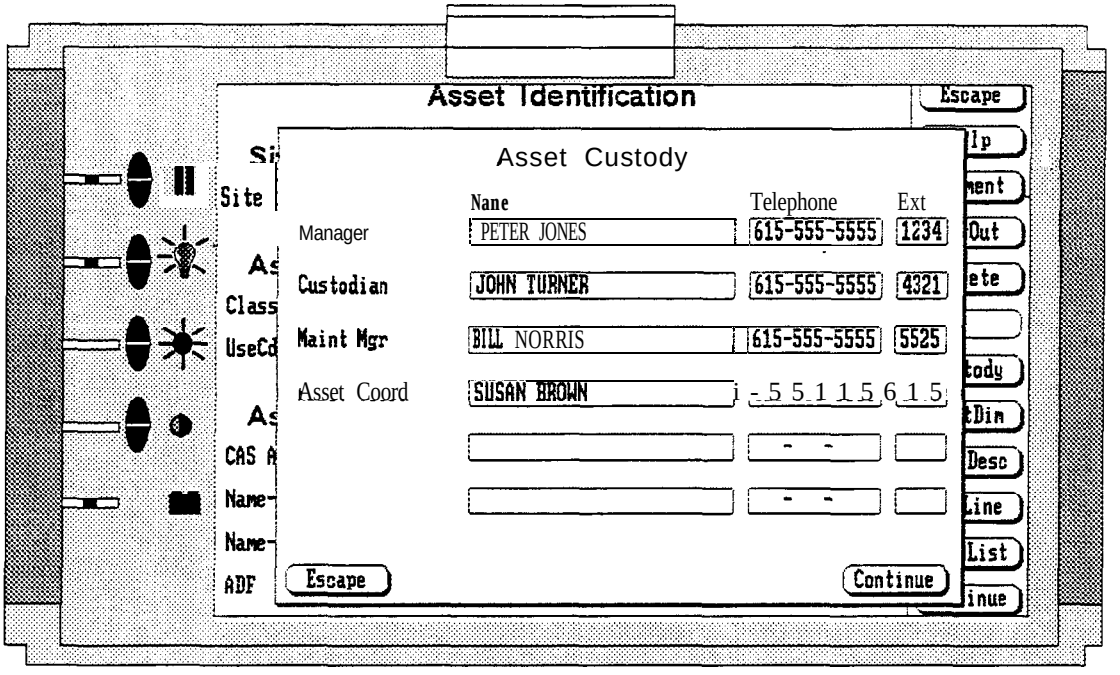
SCREEN	ACTION	COMMENT
1.0	1. Enter Name and Employee Id #	May be preloaded for security
	2. Tap "Discipline" title for picklist, cursor select or enter by pen	Picklist preformatted A=Arch, C=Site/Civil, E=Elec, M=Mech
	3. Tap "Type" and "Vers" title under Survey Data for picklist cursor select or enter by pen	Picklist preformatted for type of survey to be performed and version date for record
	4. Diagnostics data is system generated and for information purposes only	N/A
	5. Press (Continue) to go to Screen 2.0	By pressing (Continue) information is verified; corrections made by crossing through data and entering new information.
(Help)	Press to bring up screen help	Screen 99.1
(Comment)	Press to bring up screen for entering inspector comments	Screen 99.2
(LH/RH)	Press to change screen between Left or Right Hand use	N/A
(<Exec>)	Press to exit to the Grid System Menu	This option can be password protected
(DataXfer)	Press to transfer data to site computer	Used for data upload/download procedures
(Hotline)	Press for important contacts and telephone numbers	Screen 99.3
(InfoList)	Press to bring up information/directions preloaded for inspector	Screen 99.4

SURVEY STEP ASSET IDENTIFICATION Screen 2.0



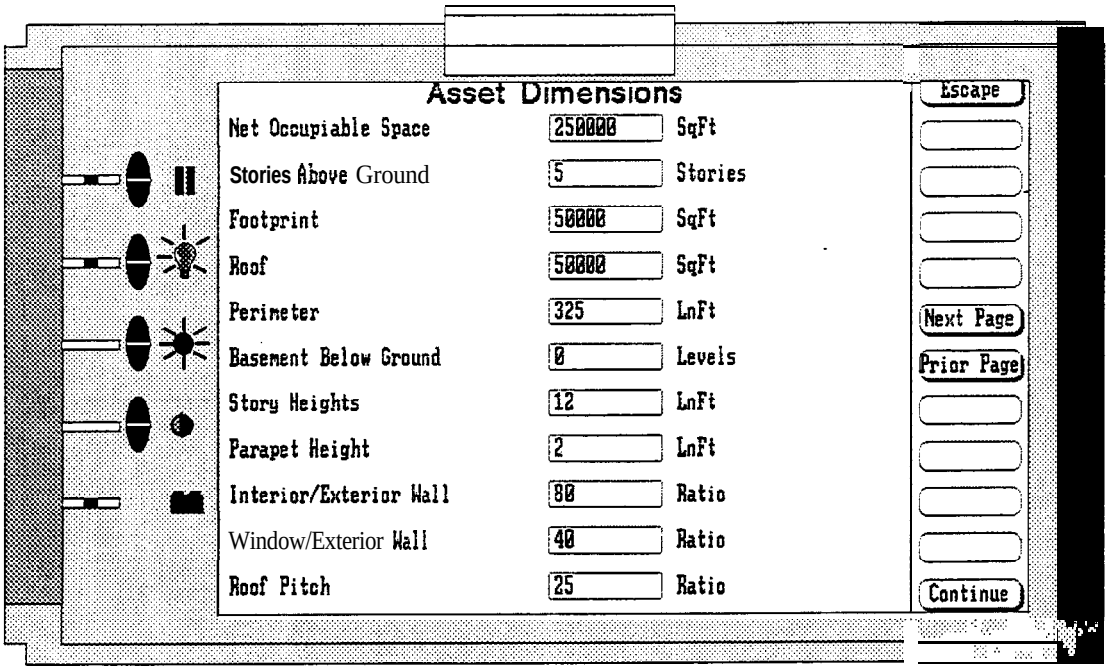
SCREEN	ACTION	COMMENT
2.0	1. Tap "Site" title for picklist Cursor select or enter by pen	Picklist can be preloaded, site code appears automatically to match name selected
	2. Tap "Class" title for picklist Cursor select or enter by pen or skip to item 4	Picklist preformatted based on RPIS categories
	3. Tap "Use Cd" title for picklist Cursor select or enter by pen or skip to item 4	Picklist preformatted based on RPIS categories
	4. Enter Asset Identification information by selecting "CAS Asset Id" corresponding "RPIS Prpty Id" and "Name-1 or Name-2" will be generated	This data can be preloaded
	5. Enter a Split Asset by creating an extension to "CAS Asset ID" and selecting a new name	This data can be preloaded or created by inspector
	6. Enter Asset Determinant Factor "ADF" provided by Site Mgr.	Determined by Site Manager prior to survey
	7. Press box next to Survey Complete upon completion of Asset Survey	N/A
	8. Press (Continue) to go to Screen 3.0	By pressing (Continue) information is verified; corrections made by crossing through data and entering new information
(Escape)	Press to return to Screen 1.0	By pressing (Escape) information is not verified and any changes made are lost
(Help)	Press to bring up screen help	Screen 99.1
(Comment)	Press to bring up screen for entering inspector comments	Screen 99.2
(Logout)	Press to save all data entered and leave survey	N/A
(Custody)	Press to bring up asset contact names	Screen 2.1 This data can be preloaded
(AssetDim)	Press to bring up screen for entering or verifying key asset dimensions	Screen 2.2 This data can be preloaded
(AssetDes)	Press to bring up screen for entering or verifying asset name, address and descriptions	Screen 2.3 Thii data can be preloaded
(HotLine)	Press for important contacts and telephone numbers	Screen 99.3
(InfoList)	Press to bring up information/directions preloaded for inspector	Screen 99.4

SURVEY STEP ASSET CUSTODY SCREEN — Screen 2.1



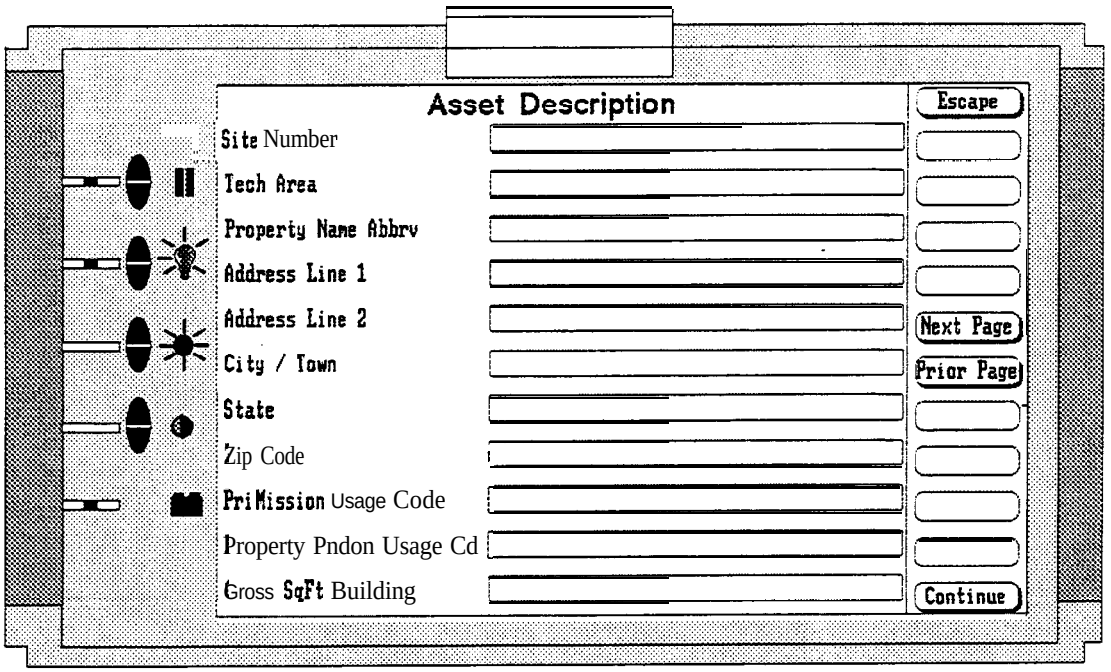
SCREEN	ACTION	COMMENT
	1. Pop up window displays important names and numbers for asset. Cross through data and make any changes	Data can be either preloaded or inspector generated.
	2. Press (Continue) to return to Screen 2.0	By pressing (Continue) information is verified; corrections made by crossing through data and entering new information.
(Escape)	Press to return to Screen 2.0	By pressing- information is not verified and any changes made are lost.

SURVEY STEP ASSET DIMENSIONS Screen 2.2



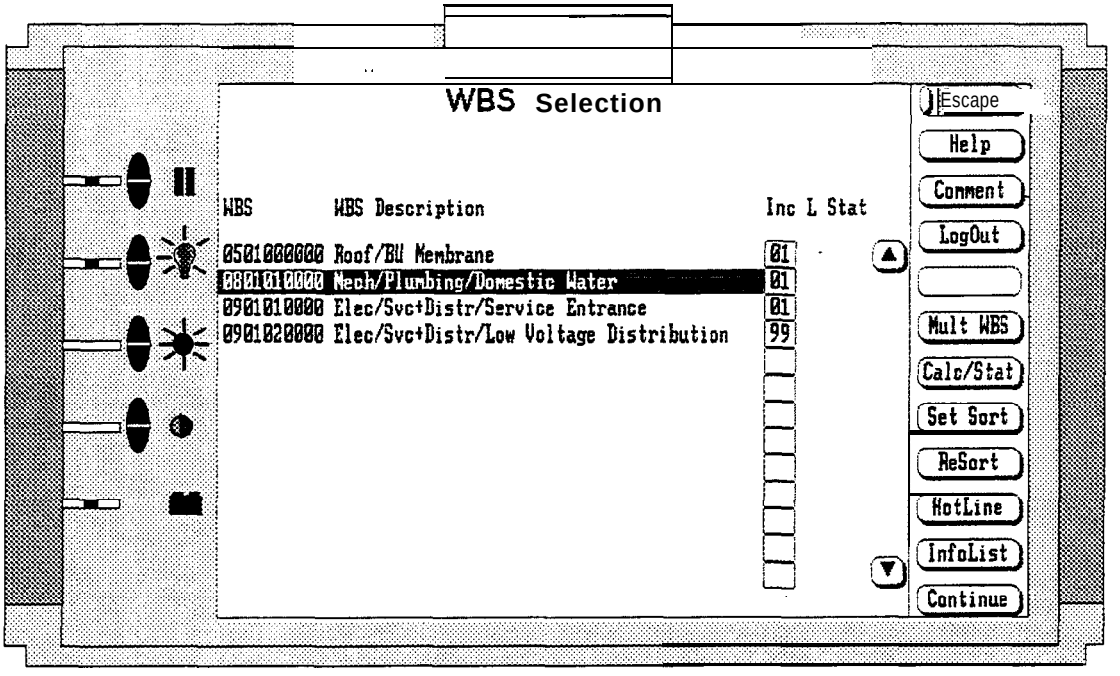
SCREEN	ACTION	COMMENT
2.2	1. Screen displays important dimension related to the asset verify data or cross through data and make any changes	Data can be either preloaded or inspector generated.
	2. Press (Continue) to return to Screen 2.0	By pressing (Continue) information is verified; corrections made by crossing through data and entering new information.
(Escape)	Press to return to Screen 2.0	By pressing (Escape) information is not verified and any changes made are lost.
(NextPage)	Press to bring up next screen of important dimensions	Data can be either preloaded or inspector generated.
(PriorPage)	Press to return to previous asset dimension screen	Data can be either preloaded or inspector generated.

SURVEY STEP ASSET DESCRIPTION Screen 2.3



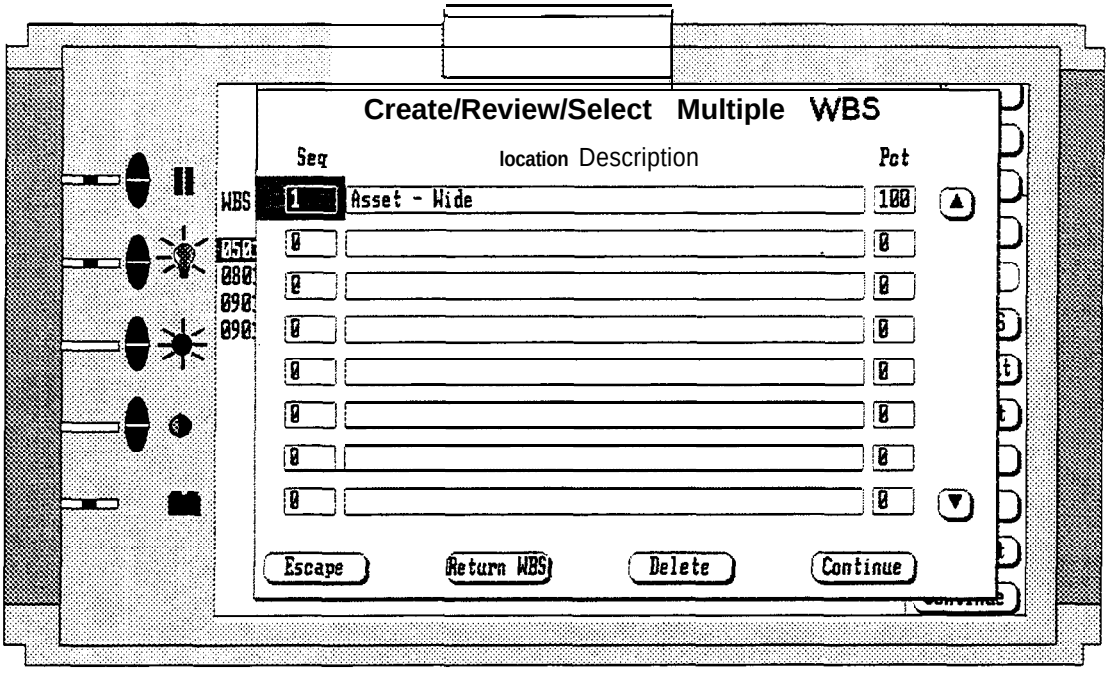
SCREEN	ACTION	COMMENT
2.3	1. Screen displays important asset description information verify data or cross through and make changes	Data can be either preloaded or inspector generated
	2. Press (Continue) to return to Screen 2.0	By pressing (Continue) information is verified; corrections made by crossing through data and entering new information
(Escape)	Press to return to Screen 2.0	By pressing (Escape) information is not verified and any changes made are lost
(NextPage)	Press to bring up next screen of important descriptions	Data can be either preloaded or inspector generated
(PriorPage)	Press to return to previous asset description screen	Data can be either preloaded or inspector generated

SURVEY STEP WBS SELECTION — Screen 3.0



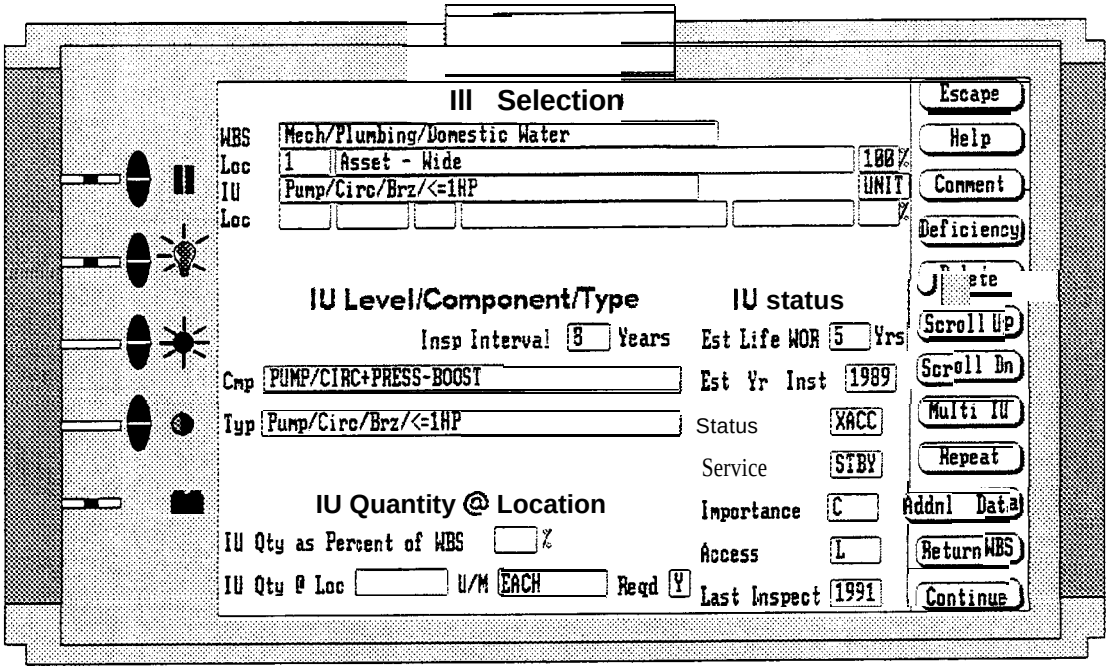
SCREEN	ACTION	COMMENT
3.0	1. Select WBS item to inspect from picklist	Picklist preformatted and is presorted by ADF numbers. Columns at end of WBS list show; "inc" (included) by sort order 1,2,3...; "M" (multiple items); and "Stat" (Status) (In Progress, Complete, or Not Started ["])
	2. All WBS for ADF included on screen; cross through number in "inc" column to deselect	By crossing through "inc" number, WBS item is deselected
	3. Press (Continue) to go to Screen 4.0	By pressing (Continue) information is verified and inspections units under the selected WBS are loaded
(Escape)	Press to return to Screen 2.0	By pressing (Escape) information is not verified and any changes made are lost.
(Help)	Press to bring up screen help	Screen 99.1
(Comment)	Press to bring up screen for entering inspector comments	Screen 992
(Logout)	Press to save all data entered and leave survey	N/A
(Multi WBS)	Press to create, view or select multiple WBS and locations	Screen 3.1
(CalcSort)	Press to recalculate the status of or number of multiple locations	N/A
(SetSort)	Resets the sort sequence of systems, etc. by accessing a pop-up window	N/A
(Resort)	Press to resort list in order of priority of WBS items selected	N/A
(HotLine)	Press for important contacts and telephone numbers	Screen 99.3
(InfoList)	Press to bring up information/directions preloaded for inspector	Screen 99.4
▲	Press Scroll Up button	Used to scroll up through information.
▼	Press Scroll Down button	Used to scroll down through information.

SURVEY STEP CREATE/REVIEW/SELECT MULTIPLE WBS **Screen 3.1**



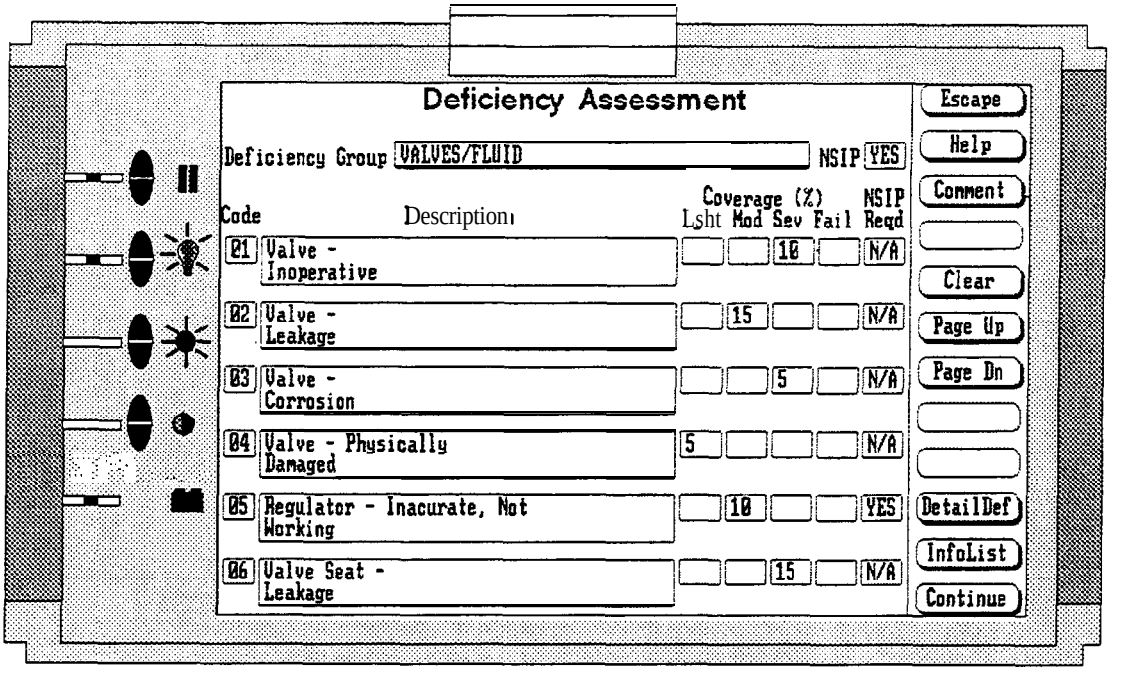
SCREEN	ACTION	COMMENT
3.1	1. Define locations of multiple WBS. Could be multiple systems or multiple parts of single system.	Inspector developed
	2. Define percentage of Asset serviced by WBS section	Inspector developed
	3. Press (Continue) after selecting multiple WBS locations from list and continue to Screen 4.0 to select Inspection Unit (IU).	By pressing (Continue) information is verified; corrections made by crossing through data and entering new information or selecting another item
(Escape)	Press to return to Screen 3.0	By pressing (Escape) information is not verified and any changes made are lost
(RtrnWBS)	Press to return to WBS selection screen to make additional selections	N/A
(Delete)	Press to delete a highlighted entry on screen	N/A
▲	Press scroll up button	Used to scroll up through information.
▼	Press scroll down button	Used to scroll down through information.

SURVEY STEP IU SELECTION Screen 4.0



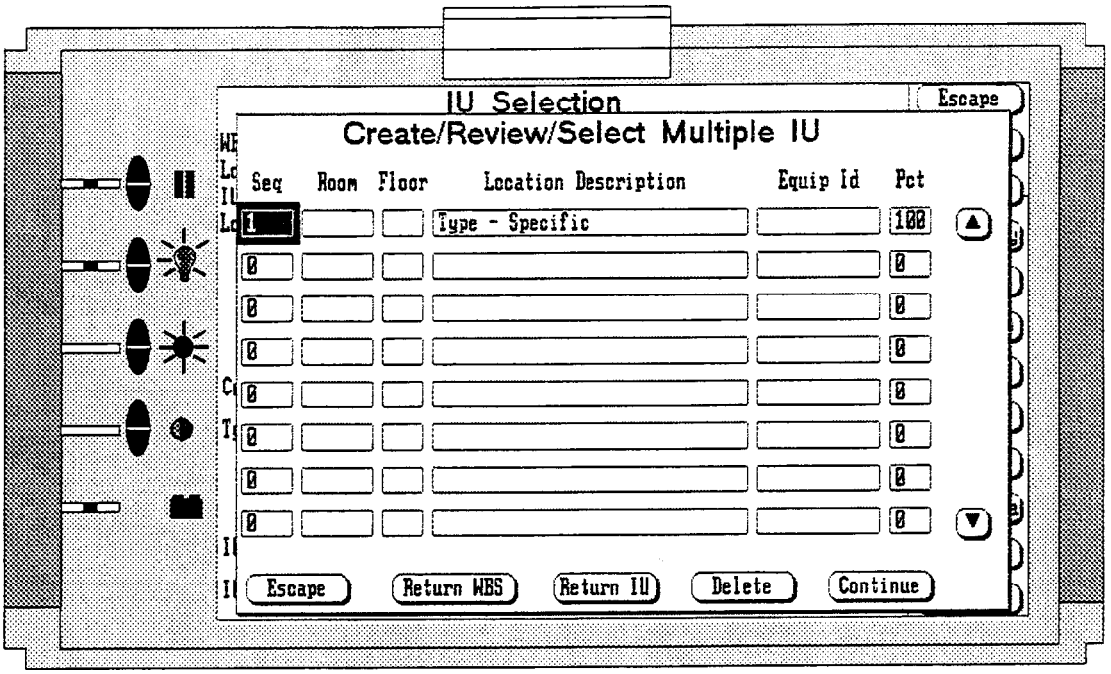
SCREEN	ACTION	COMMENT
4.0	1. Tap "Cmp" title for component picklist Cursor select or enter by pen	Picklist is preformatted
	2. Tap "Typ" title for type of component picklist Cursor select or enter by pen	Picklist is preformatted
	3. Press (Deficiency) to bring up deficiency assessment screen	Screen 4.1 brings up deficiency picklist for WBS IU
	4. Enter estimated life without repair	Inspector generated
	5. Enter estimated year "IU" installed	Inspector generated
	6. Tap "Status" title for picklist Cursor select or enter by pen	Picklist is preformatted
	7. Tap "Service" title for picklist Cursor select or enter by pen	Picklist is preformatted
	8. Tap "Importance" title for picklist	Picklist is preformatted
	9. Tap "Access" title for picklist Cursor select or enter by pen	Picklist is preformatted
	10. Enter year "IU" last inspected	Inspector generated
	11. Enter percentage of WBS served by inspection unit	Inspector generated
	12. Enter quantity of inspection unit at location as required	Inspector generated
	13. Press (Continue) to go to Screen 5.0	By pressing (Continue) information is verified; corrections made by crossing through data and entering new information
(Escape)	Press to return to Screen 3.0	By pressing (Escape) information is not verified; and any changes made are lost
(Help)	Press to bring up screen help	Screen 99.1
(Comment)	Press to bring up screen for entering inspector comments	Screen 99.2
(Delete)	Press to delete an inspection unit record	N/A
(Scroll Up)	Press to scroll up thru inspection units selected	N/A
(Scroll Dn)	Press to scroll down thru inspection units selected	WA
(Multi IU)	Press to create, view, or select multiple IU's and locations	Screen 4.2
(Repeat)	Press to repeat or copy inspection unit selection data as a new entry	N/A
(AddnlData)	Press to bring up Additional Data screen and enter boiler plate information	Screen 4.3 - Inspector generated
(RtrnWBS)	Press to save data entered and go to Screen 3.0 for next selection	By pressing (RtrnWBS) information is verified; corrections made by crossing through data and entering new information

SURVEY STEP DEFICIENCY ASSESSMENT Screen 4.1



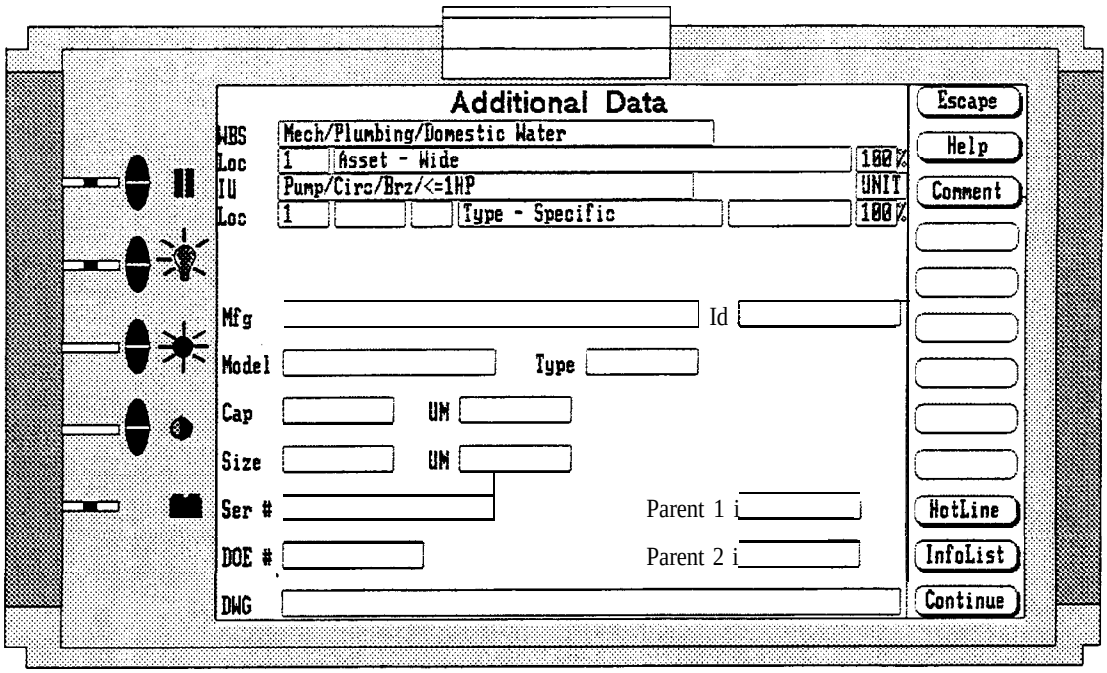
SCREEN	ACTION	COMMENT
4.1	1. Select deficiency from list	Picklist preformatted
	2. Select degree of severity of deficiency	Inspector developed
	3. Enter percentage of coverage under selected severity	Inspector developed
	4. Indicate whether non-standard inspection/test procedures are required or recommended	Inspector choice, preset at "No"; line through to deselect
	5. Press (Continue) to go to Screen 5.0	By pressing (Continue) information is verified; corrections made by crossing through data and entering new information
(Escape)	Press to return to Screen 4.0	By pressing (Escape) information is not verified and any changes made are lost
(Help)	Press to bring up screen help	Screen 99.1
(Comment)	Press to bring up screen for entering inspector comments	Screen 99.2
(Clear)	Press to unselect a deficiency	N/A
(Page Up)	Press to scroll up though data by page	N/A
(Page Dn)	Press to scroll down through data by page	N/A
(Detail Def)	Press to bring up long description of selected deficiency	N/A
(InfoList)	Press to bring up information/directions preloaded for inspector	Screen 99.4

SURVEY STEP CREATE/REVIEW/SELECT MULTIPLE IU — Screen 4.2



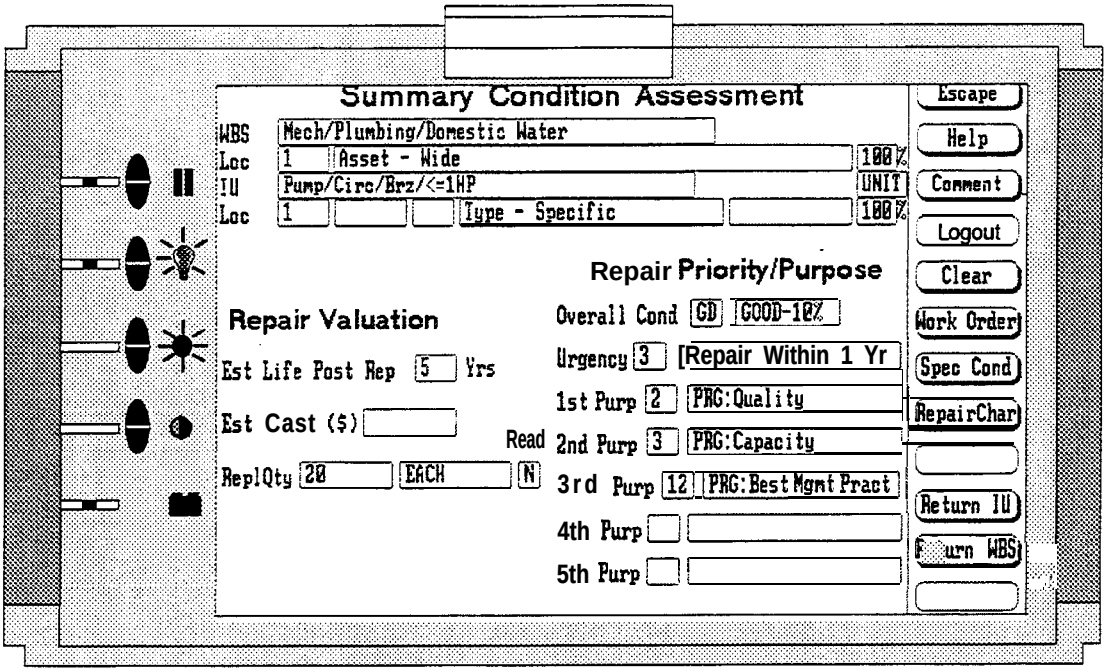
SCREEN	ACTION	COMMENT
4.2	1. Define locations of Multiple IU's by room, floor and/or location description - optional equipment identification number can be added	Inspector developed
	2. Define percentage of Asset or WBS serviced by IU	Inspector developed
	3. Press (Continue) after selecting Multiple IU location from list and continue to Screen 4.1 to select deficiencies	By pressing (Continue) information is verified; corrections made by crossing thru data and entering new information or selecting another item
(Escape)	Press to return to **Screen** 4.0	By pressing-information is not **verified** and any changes made are lost
(RtrnWBS)	Press to return to **Screen** 3.0	**N/A**
(RtrnIU)	Press to return to **Screen** 4.0	N/A
(Delete)	Press to delete a highlighted entry on screen	**N/A**
▲	Press scroll up button	Used to scroll up through information
▼	Press scroll down button	Used to scroll down through information

SURVEY STEP ADDITIONAL DATA — Screen 4.3



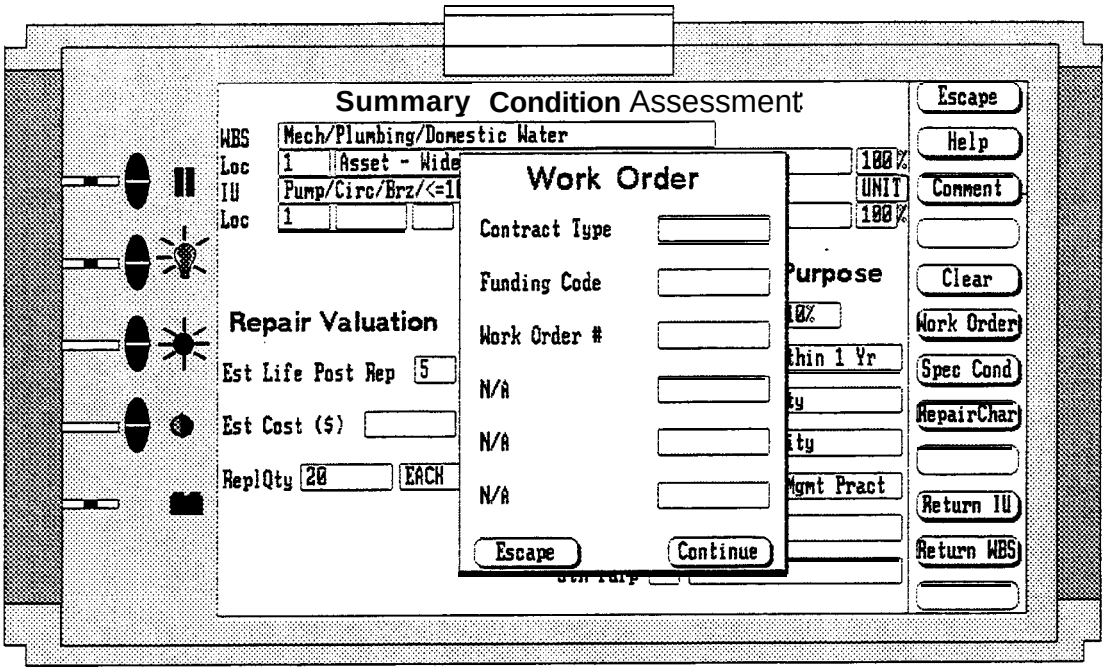
SCREEN	ACTION	COMMENT
4.3	1. Enter boiler plate data about component being inspected	Inspector generated from data on the component, drawing specifications or determined in the field. This data can be used for inventorying inspection units
	2. Press (Continue) to go to Screen 4.0	By pressing (Continue) information is verified; corrections made by crossing through data and entering new information
(Escape)	Press to return to Screen 4.0	By pressing (Escape) information is not verified; and any changes made are lost
(Help)	Press to bring up screen help	Screen 99.1
(Comments)	Press to bring up screen for entering inspector comments	Screen 99.2
(Hotline)	Press for important contacts and telephone numbers	Screen 99.3
(InfoList)	Press to bring up information/directions preloaded for inspector	Screen 99.4

SURVEY STEP SUMMARY CONDITION ASSESSMENT — Screen 5.0



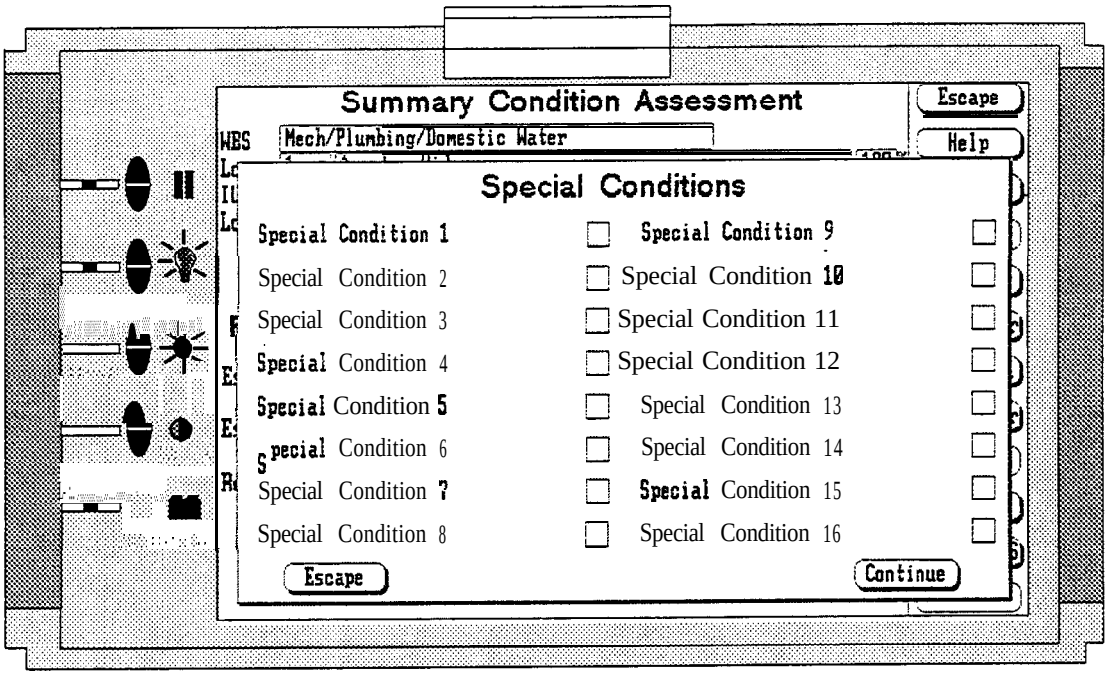
SCREEN	ACTION	COMMENT
5.0	1. Tap "Overall Condition" title for picklist Cursor select or select by pen	Picklist preformatted, inspector determined
	2. Tap "Urgency" title for picklist Cursor select or enter by pen	Picklist preformatted, inspector determined
	3. Tap "Purp" title for picklist Cursor select or enter by pen Multiple purposes can be specified	Picklist preformatted inspector determined
	4. Enter estimated life of IU after repairs in years	Inspector determined
	5. Enter an estimated cost for repairs (optional)	Inspector determined
	6. Enter repair quantity as required	Inspector determined
	7. Press to save data entered and go to Screen 4.0 for next selection	By pressing (ReturnIU) information is verified; corrections made by crossing through data and entering new information
	8. Press to save data entered and go to Screen 3.0 for next selection	By pressing (ReturnWBS) information is verified; corrections made by crossing through data and entering new information
(Escape)	Press to return to Screen 4.0	By pressing (Escape) information is not verified and any changes made are lost
(Help)	Press to bring up screen help	Screen 99.1
(Comment)	Press to bring up screen for entering inspector comments	Screen 99.2
(Logout)	Press to save all data entered and leave survey	N/A
(Clear)	Press to clear or delete an entry	N/A
(Work Order)	Press to bring up work order screen pop-up	Screen 5.1
(Spec Cond)	Press to bring up special condition screen pop-up	Screen 5.2
(Repair Char)	Press to bring up special repair characteristics screen pop-up	Screen 5.3

SURVEY STEP WORK ORDER GENERATION **Screen 5.1**



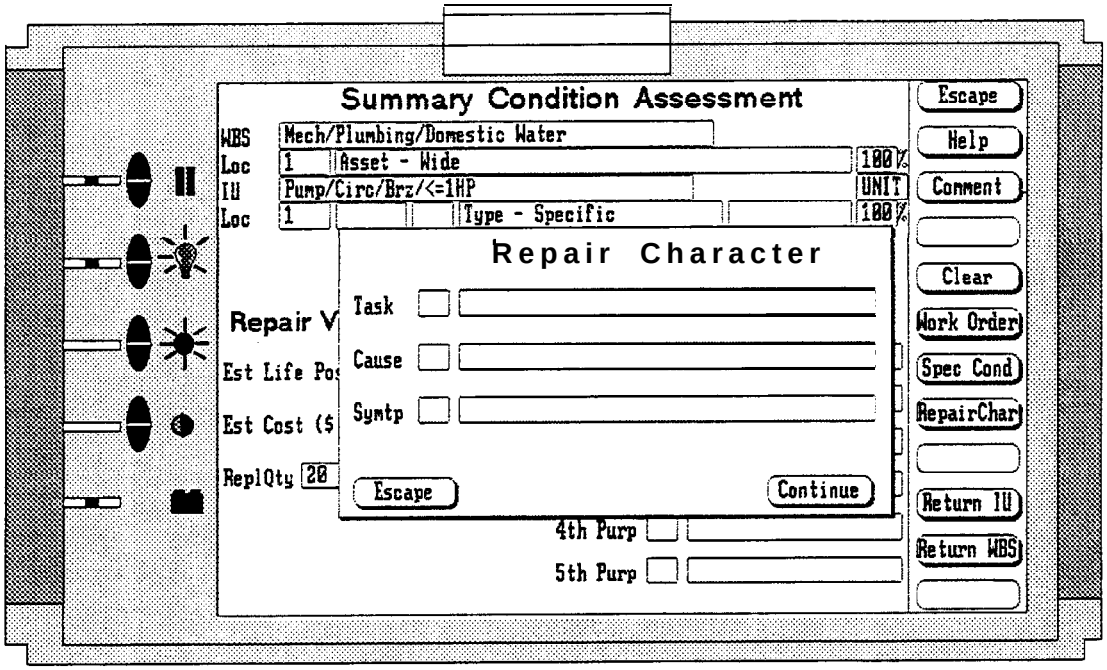
SCREEN	ACTION	COMMENT
5.1	1. Enter data to define Work Order number to tag repair to create a job estimate for repairs	Inspector generated as determined by Site Manager prior to survey
	2. Press (Continue) to go to Screen 5.0	By pressing (Continue) information is verified; corrections made by crossing through data and entering new information
	3. Press (Escape) to return to Screen 5.0	By pressing- information is not verified; and any changes made are lost

SURVEY STEP SPECIAL CONDITIONS SELECTION — Screen 5.2



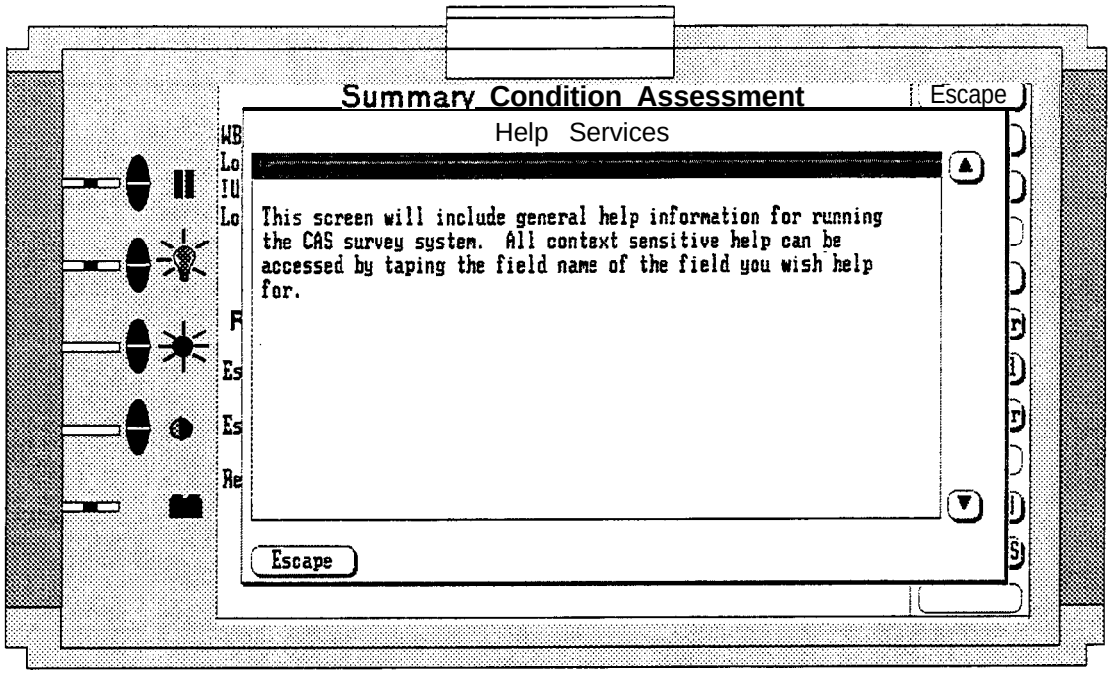
SCREEN	ACTION	COMMENT
5.2	1. Press box next to special condition to select	Picklist is preloaded by site. Selections determined by Site Manager prior to survey
	2. Press Continue to go to Screen 5.0	By pressing Continue information is verified: corrections made by crossing through data and entering new information
	3. Press-to return to Screen 5.0	By pressing Escape information is not verified; and any changes made are lost

SURVEY STEP REPAIR CHARACTER DOCUMENTATION — Screen 5.3



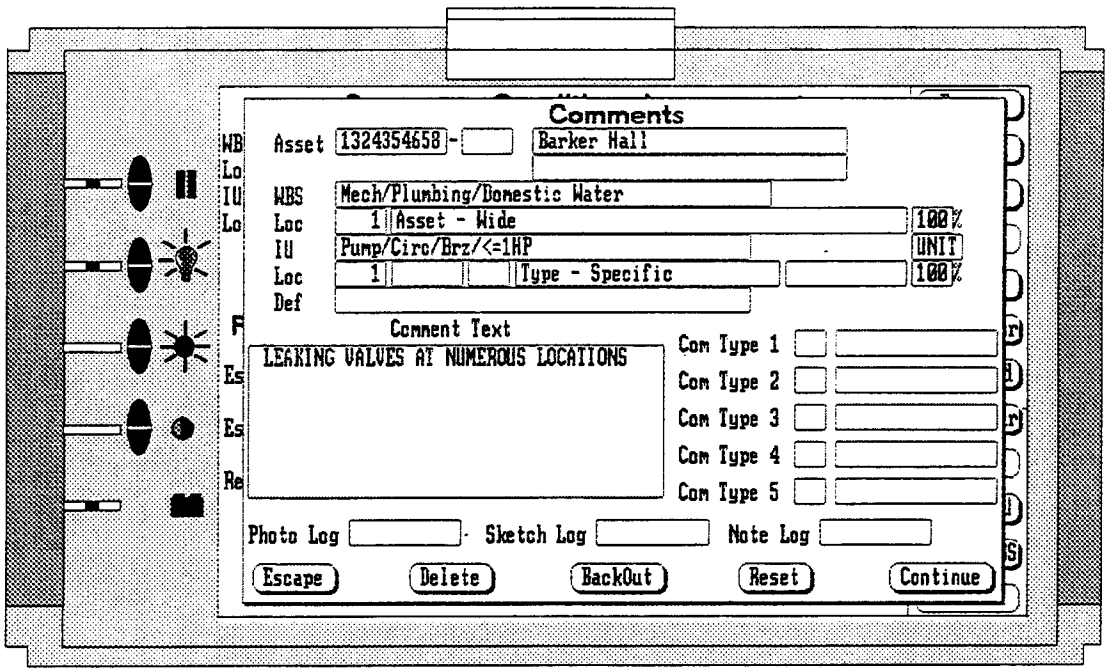
SCREEN	ACTION	COMMENT
5.3	1. Enter repair characteristics for tracking related deficiencies	Inspector generated from input of asset users to document what is deficient, what caused deficiency and any symptoms. Picklist can be preformatted
	2. Press (Continue) to go to Screen 5.0	By pressing (Continue) information is **verified;** corrections made by crossing through data and entering new information
	3. Press-to return to Screen 5.0	By pressing- information is not verified; and any changes made are lost

SURVEY STEP HELP — Screen 99.1



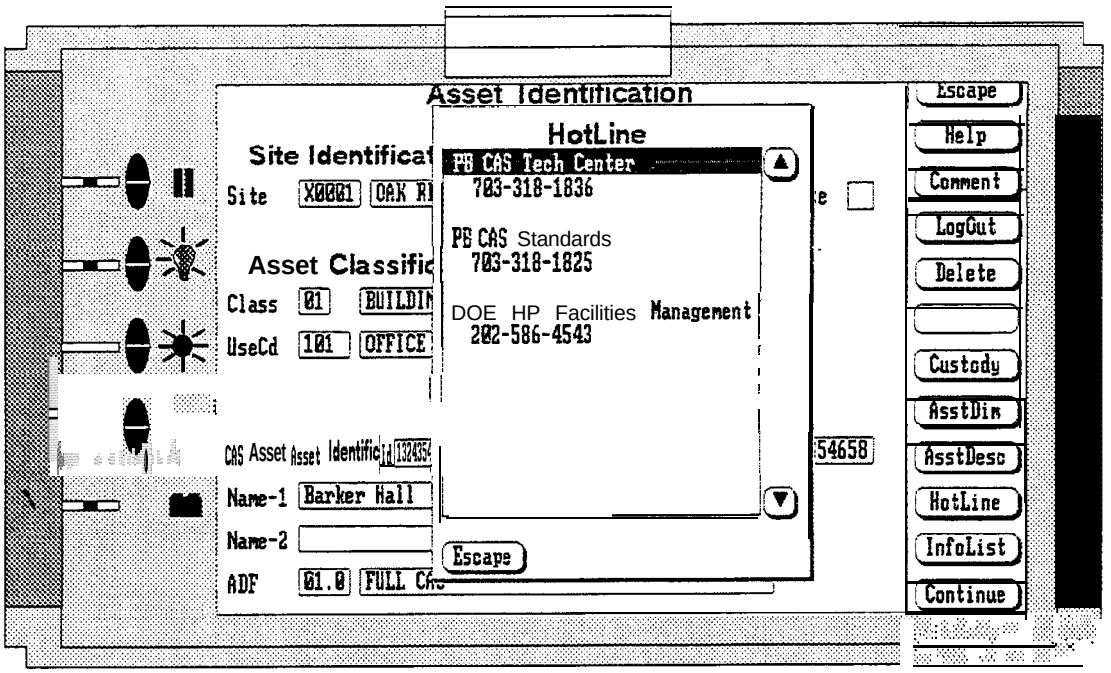
SCREEN	ACTION	COMMENT
99.1	N/A	Screen pop-up help information Dynamic help for locations selected Screen data cannot be changed
Escape	Press to exit Help Screen and return to previous screen	N/A
▲	Press scroll up button	Used to scroll up through information
▼	Press scroll down button	Used to scroll down through information

SURVEY STEP COMMENT SCREEN — Screen 99.2



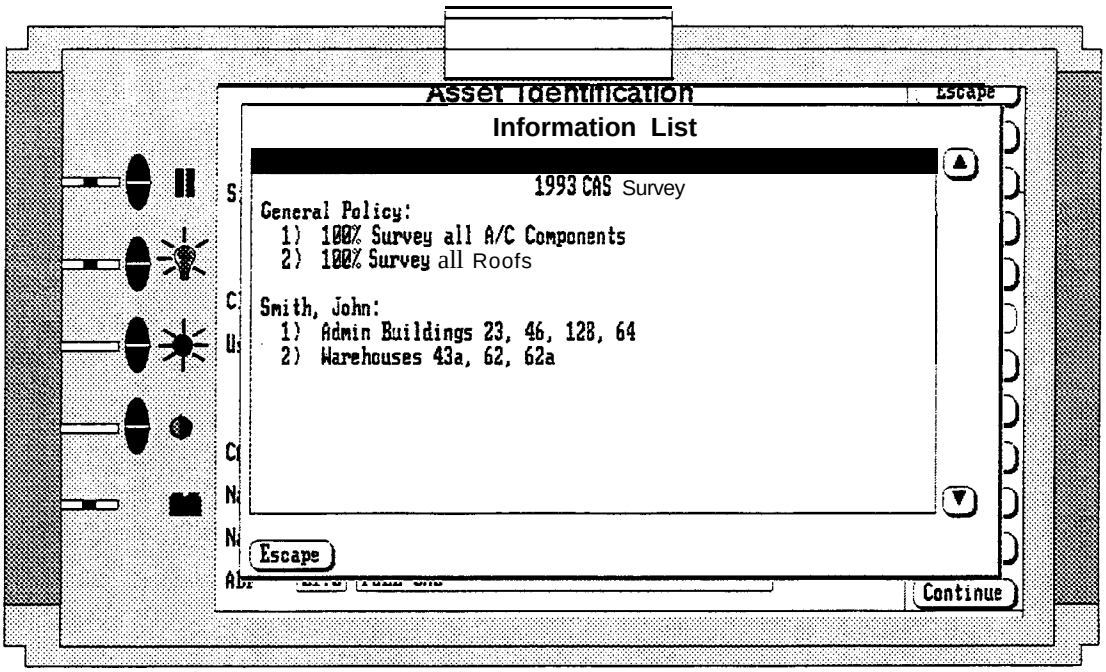
SCREEN	ACTION	COMMENT
99.2	1. Select a Comment Type Selection	Picklist preformatted
	2. Enter Comment inside comment text field (QWERTY keyboard can be called in to use)	Text field expands as required
	3. Enter a Photo, Sketch, or Note Log tag number	Can be standardized or inspector generated
	4. Press (Continue) to return to previous screen	By pressing (Continue) information is verified; corrections made by crossing thru data and entering new information
(Escape)	Press to exit comment screen and return to previous screen	By pressing (Escape) information is not verified and any changes made are lost
(Delete)	Press to delete a selected comment	N/A
(Backout)	Press to move backwards through the navigation screen at top	This option allows an inspector to move backwards to enter or change a comment tagged to a previous screen
(Reset)	Press to move forward through the navigation screen at top	This option allows an inspector to move forward after entering a comment on a previous screen to continue the inspection

SURVEY STEP HOTLINE SCREEN — Screen 99.3



SCREEN	ACTION	COMMENT
99.3	N/A	Screen pop-up for important contacts and telephone numbers. Preformatted and adjusted by Site Manager. Screen data cannot be changed by inspector
Escape	Press to exit Hotline screen and return to previous screen	N/A
▲	Press **scroll** up button	Used to scroll up through information
▼	Press scroll down button	Used to scroll **down** through information

SURVEY STEP INFO SCREEN Screen 99.4



SCREEN	ACTION	COMMENT
99.4	1. CAS inspection parameters & schedules as inputted by site manager	Cannot be changed by inspector
Escape	Press to exit InfoList screen and return to previous screen	N/A
▲	Press scroll up button	Used to scroll up through information
▼	Press scroll down button	Used to scroll down through information

DATA COLLECTION METHODS

END OF SUBSECTION

FEDERAL SPECIFICATIONS

FEDERAL SPECIFICATION	TITLE
10 CFR 435	DOE Energy Conservation
29 CFR 1910	Occupational Safety & Health Standards
40 CFR 112	Oil Pollution Prevention
40 CFR 141	National Primary Drinking Water Regulations
40 CFR 280	Underground Storage Tanks
DOE 9480.7	Fire Protection
DOE 6430.1 A	DOE General Design Criteria
FS **TT-S-001657**	Joint and Seam Sealant
FS **WW-P460b**	Pipe Fittings, Bronze, Cast
FS **WW-P47b**	Pipe Fittings, Ferrous, Threaded
FS **WW-P541**	Plumbing Fixtures
GSA PBS P 9850.18	Maintenance Guidelines

FEDERAL SPECIFICATIONS

END OF SUBSECTION

NATIONAL STANDARDS

AIR MOVEMENT & CONTROL ASSOCIATION (AMCA)

AMCA 99	Standards Handbook
AMCA 201	Fans and Systems
AMCA 210	Laboratory Methods of Testing Fans for Rating Purposes
AMCA 300	Test Code for Sound Rating
AMCA 301	Method for Calculating Fan Sound Ratings From Laboratory Test Data
AMCA 500	Test Method for Louvers, Dampers and Shutters

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B 9.1	Safety Code Requirements Pertaining to Unit Construction of Reciprocating Chillers
ANSI 816.4	Cast-Iron Threaded Fittings
ANSI B16.5	Steel Flanges and Flanged Fittings
ANSI B31.5	ASME Code for Pressure Piping - Refrigerant Piping
ANSI 263.6	Gas Unit Heaters
ANSI Z83.9	Gas-Fired Duct Furnaces

AIR CONDITIONING & REFRIGERATION INSTITUTE (ARI)

ARI 210	Standard for Unitary Air-Conditioning Equipment
ARI 270	Standard for Sound Rating of Outdoor Unitary Equipment
ARI 330	Unit Ventilators
ARI 360	Standard for Commercial and Industrial Unitary Air-Conditioning Equipment
ARI 410	Forced-Circulation Air-Cooling and Air-Heating Coils
ARI 430	Central-Station Air-Handling Units
ARI 440	Room Fan-Coil Air Conditioners
ARI 450	Water Cooled Refrigerant Condensers, Remote
ARI 460	Remote Mechanical-Draft Air Cooled Refrigerant Compressors
ARI 520	Positive Displacement Refrigerant Compressors and Condensing Units
ARI 550	Centrifugal or Rotary Water-Chilling Packages
ARI 590	Reciprocating Water-Chilling Packages
ARI 610	Standard for Central System Humidifiers
ARI 620	Standard for Self-Contained Humidifiers
ARI 630	Standard for Selection, Installation, and Servicing of Humidifiers
ARI 650	Standard for Air Outlets and Inlets
ARI 650	Commercial and Industrial Air Filter Equipment
ARI 660	Industry Standard for Air Terminals
ARI 1010	Drinking Fountains and Self-Contained Mechanically Refrigerated Drinking Water Coolers

NATIONAL STANDARDS

AMERICAN SOCIETY OF HEATING, REFRIGERATION & AIR CONDITIONING ENGINEERS (ASHRAE)

ASHBAE 3	Guidelines to Reduce CFC Refrigerant Emissions
ASHBAE 15	Safety Code for Mechanical Refrigeration
ASHBAE 20	Methods of Testing for Rating Remote Mechanical Draft Air Cooled Refrigerant Condensers
ASHBAE 24	Methods of Testing For Rating Liquid Coolers
ASHBAE 33	Methods of Testing Forced Circulation Air Cooling and Heating Coils
ASHBAE 51	Methods of Testing Fans for Rating
ASHBAE 52	Method of Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
ASHBAE 62	Ventilation for Acceptable Indoor Air Quality
ASHRAE 64	Methods of Testing Remote Mechanical Draft Evaporative Refrigerant Condensers
ASHBAE 70	Method of Testing for Rating the Air Flow Performance of Outlets and Inlets
ASHBAE 90A	Energy Conservation in New Building Design
ASHBAE 100	Energy Conservation in Existing Buildings

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME	Boiler and Pressure Vessel Code
ASME AI 7.1	Elevators and Escalators
ASME B16	Fittings Flanges and Valves
ASME B16.1	Cast-Iron Pipe Flanges
ASME B16.11	Forged-Steel Pipe Fittings
ASME 816.22	Copper Tube Fittings
ASME 816.3	Malleable-Iron Pipe Fittings
ASME B16.5	Steel Pipe Flanges
ASME B16.9	Wrought-Steel Pipe Fittings
ASME 831.1	Power Piping
ASME B31.3	Chemical Plant and Petroleum Refinery Piping
ASME 831.9	Building Services Piping
ASME CSD-1 ,1A	Controls and Safety Devices for Automatically Fired Boilers
ASME PTC4.1	Steam Generating Units

AMERICAN SOCIETY FOR TESTING & MATERIALS (ASTM)

ASTM A36	Trapeze and Riser Supports
ASTM A47	Malleable-Iron Pipe Fittings
ASTM A63	Steel Pipe
ASTM AI06	Steel Pipe Fittings
ASTM AI26	Cast Iron Valves
ASTM A234	Steel Fittings
ASTM A276	Float and Thermostatic Traps
ASTM A366	Carbon Steel Sheets
ASTM A490	Stainless Steel Sheets

NATIONAL STANDARDS

AMERICAN SOCIETY FOR TESTING & MATERIALS (ASTM) (Continued)

AS1ΓM A525	G90 Zinc Coating, Mill Phosphated.
AS1ΓM A526	Galvanized Steel for Panel Surfaces, Internal Channels, and Trim Items
AS1ΓM A527	Galvanized Steel as Used in Breechings
AS1ΓM A536	Ductile-Iron Pipe Fittings
AS1ΓM A569	Black, Carbon, Hot-Rolled Steel as Used in Breechings
ASTM B 6 2	Bronze Valves
ASTM B 8 8	Copper Tubing as Drawn Temper, Type L or Annealed Type K
ASTM 8117	Erosion Testing of Cooling Towers
ASTM B209	Aluminum Sheets
ASTM 8280	Copper Tubing Type ACR
ASTM C423	Testing Sound Absorption Coefficients
ASTM C916.9	Liner Adhesive
ASTM C920	Flanged Joint Mastics
ASTM C1071	Duct Liner
ASTM D 859	Tests for Silica in Water and Waste Water
ASTM D1066	Sampling Steam.
ASTM D1067	Tests for Acidity or Alkalinity of Water
AS1'M D1068	Tests for Iron in Water
ASTM D1126	Tests for Hardness in Water
AS1'M D1888	Tests for Particulate and Dissolved Matter in Water
ASTM D2794	Impact Testing of Cooling Towers
ASTM D2846	Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe
AS1'M D3370	Practices for Sampling Water
ASTM D4012	Glass Fibre Reinforces Underground Storage Tanks

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8	Brazing Filler Metals Classification BAg1 (silver)
AWS D1.1	Structural Welding Code - Steel
AWS D1.2	Structural Welding Code - Aluminum
AWS DI.3	Structural Welding Code - Sheet Steel
AWS D5.2	Standard for Welded Steel, Elevated Tanks, Standpipes and Reservoirs for Water Storage
AWS D9.1	Sheet Metal Welding Code

INSTITUTE OF ELECTRICAL & ELECTRONIC ENGINEERS (IEEE)

IEEE 112	Test Method B for Motor Efficiency

NATIONAL ASSN OF PLUMBING/HEATING/COOLING CONTRACTORS (NAPHCC)

NSPC	National Standard Plumbing Code

NATIONAL STANDARDS

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 11	Low Expansion Foam & Combined Agent Systems
NFPA 12	Carbon Dioxide Extinguishing Systems
NFPA 12a	Halon 1301 Fire Extinguishing Systems
NFPA 12b	Halon 1211 Fire Extinguishing Systems
NFPA 13	Standard for Installation of Sprinkler System.
NFPA 13A	Inspection, Testing and Maintenance of Sprinkler System.
NFPA 14	Standard for Installation of Standpipe and Hose System.
NFPA 15	Water Spray Fixed Systems for Fire Protection Extinguishing Systems
NFPA 16	Installation of Deluge Foam Water Sprinkler and Foam-Water Spray Systems
NFPA 16a	Installation of Closed Head Foam Water Sprinkler Systems
NFPA 17	Dry Chemical Extinguishing Systems
NFPA 1662	Standard for Care, Use and Maintenance of Fire Hose
NFPA 1663	Fire Hose Connections; Screw Threads and Gaskets
NFPA 20	Standard for the Installation of Centrifugal Fire Pumps.
NFPA 211	Standard for Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances
NFPA 22	Standard for Water Tanks for Private Fire Protection
NFPA 231	Standard for General Storage
NFPA 24	Standard for Installation of Fire Service Mains and Their Appurtenances
NFPA 26	Recommended Practices for the Supervision of Valves Controlling Water Supplies for Fire Protection
NFPA 30	Flammable and Combustible Liquids Code
NFPA 31	Oil Burning Equipment
NFPA 37	Standard for the Installation and use of Stationary Combustion Engines and Gas Turbines
NFPA 46	Fire Protection for Laboratories Using Chemicals
NFPA 60	Oxygen Systems, Bulk
NFPA 50A	Gaseous Hydrogen Systems
NFPA 60B	Liquefied Hydrogen Systems
NFPA 64	National Fuel Gas Code
NFPA 56F	Test Medical Gas Piping, Including Pressure, Cross Connection, and Final Testing
NFPA 66	Storage and Handling of Liquid petroleum Gas
NFPA 66	Explosion Venting
NFPA 70	National Electrical Code
NFPA 72	Protective Signaling System
NFPA 72E	Automatic Fire Detectors
NFPA 85A	Prevention of Furnace Explosions in Fuel Oil and Natural Gas Fired Single Burner Boiler Furnaces

NATIONAL STANDARDS

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 85B	Prevention of Furnace Explosions in Natural Gas Fired Multiple Burner Boiler Furnaces
NFPA 85D	Prevention of Furnace Explosions in Fuel Oil Fired Multiple Burner Boiler Furnaces
NFPA %E	Prevention of Furnace Explosions in Pulverized Coal Fired Multiple Burner Boiler Furnaces
NFPA 85F	Installation and Operation of Pulverized Fuel Systems
NFPA 90A	Standard for the Installation of Air-Conditioning and Ventilating Systems
NFPA 90B	Standard for the Installation of Warm Air Heating and Air-Conditioning Systems
NFPA 96	Standard for the Installation of Eauipment for the Removal of Smoke and Grease-Laden Vapors for Commercial Cooking Equipment
NFPA 99	Health Care Facilities

PLUMBING & DRAINAGE INSTITUTE (PDI)

PDI G101	Testing and Rating Procedure for Grease Interceptors

SHEET METAL & AIR CONDITIONING CONTRACTORS ASSOCIATION (SMACNA)

SMACNA AFDS-100-73	Pressure Sensitive Tape

UNDERWRITERS LABORATORIES (UL)

UL 58	Steel Underground Tanks for Flammable and Combustible Liquids
UL 80	Standard for Steel Inside Tanks for Oil-Burner Fuel
UL 174	Household Electric Storage Tank Water Heaters
UL 207	Refrigerant Containing Components and Accessories
UL 343	Standard for Pumps for Oil-Burning Appliances
UL 443	Steel Auxiliary Tanks for Oil-Burner Fuel
UL 448	Fire Pumps
UL 485	Central Cooling Air Conditioners
UL 5%	Industrial Control Equipment
UL 587	Pipe Connections for Flammable and Combustible Liquids and LP-Gas
UL 586	High Efficiency, Particulate, Air-Filter Units
UL 7%	Power Ventilators - Design, Manufacture, and Testing
UL 731	Oil-Fired Unit Heaters
UL 732	Oil Fired Water Heaters
UL 778	Motor Operated Water Pumps
UL 834	Heating, Water Supply, and Power Boilers - Electric
UL 883	Safety Standards for Fan Coil Units and Room Fan Heater Units
UL 8%	Test Performance of Air Filter Units
UL 959	Refractory Lining Testing for Temperature and Acid Resistance
UL 984	Hermetic Refrigerant Motor Compressors

NATIONAL STANDARDS

UNDERWRITERS LABORATORIES (UL)

UL 1247	Fire Pump Diesel Engine Driver
UL 1261	Electric Water Heaters for Pools and Tubs
UL MH 1316	Standard for Glass-Fiber Reinforced Plastic Underground Storage Tanks for Petroleum Products
UL 1453	Electric Booster and Commercial Storage Tank Water Heaters
UL 1476	Relief valves
UL 1479	Fire Test of Through Penetration Fire Stops

END OF SUBSECTION

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"Fibrous Glass Duct Construction Standard," 5th Ed., 1979. SMACNA	Sheet Metal & Air Conditioning Contractors' National Association P.O. Box 70 Merrifield, VA 22116
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"Maintenance Engineering Handbook", Lindley R. Higgins. McGraw-Hill Book Company, New York, NY. 1977.

"Means Facilities Maintenance Standards," Roger W. Liska. R.S. Means Company, Inc., Kingston, MA. 1988.

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"Mechanical and Electrical Equipment for Buildings," William J. McGuinness et al., John Wiley and Sons, Inc. New York, NY. 1971.

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"Service Life of Rehabilitated Buildings and Other Structures," ASTM STP 1098, Kelley/Marshall, ASTM. Philadelphia, PA. 1986.

Compressed Gas Association Pamphlets:

- G-4 Oxygen
- G-5 Hydrogen
- G-6 Carbon Dioxide
- P-l Safe Handling of Compressed Gases
- P-9 Inert Gases - Argon
- P-12 Safe Handling of Cryogenic Liquids

OTHERRELATEDREFERENCES

END OF SUBSECTION

APPENDIX A

ABBREVIATIONS

A, Amp	Ampere, Area
A/E	Architect-Engineer
AA	Aluminum Association
AABC	Associated Air Balance Council
AAMA	American Architectural Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
ABYA	American Boiler Manufacturers Association
ABS	Acrylonitrile-Butadiene-Styrene
AC	Alternating Current, Air Conditioning
ACFM	Actual Cubic Feet per Minute
ACGIH	American Conference of Governmental Industrial Hygienists
ACI	American Concrete Institute
ACSM	American Congress on Surveying and Mapping
ADF	Asset Determinant Factor
ADJ	Adjustable
ADM	Action Description Memorandum
ADP	Automated Data Processing
AEC	U.S. Atomic Energy Commission
AFM	U.S. Air Force Manual
AFR	U.S. Air Force Regulation
AFWL	U.S. Air Force Weapons
AGA	American Gas Association
AHU	Air Handling Unit
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel institute
ALARA	As Low as Reasonably Achievable
Allow	Allowance
Amb	Ambient
AMC	U.S. Army Materiel Command
AMCA	Air Movement Contractors Association
AMC-R	Army Materiel Command Regulation
Amp	Ampere
ANS	American Nuclear Society
ANSI	American National Standards Institute
API	American Petroleum Institute
Approx.	Approximately
AR	U.S. Army Regulation
AREA	American Railway Engineering Association
ARI	American Refrigeration Institute
ARMA	Asphalt Roofing Manufacturers Association
ASBC	American Standard Building Code
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigeration & Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATM	Atmosphere
AVG	Average
AVLIS	Atomic Vapor Laser Isotope Separation
AWG	American Wire Gauge

APPENDIX A

AWS	American Welding Society
AWWA	American Water Works Association
BAT	Best Available Technology
BATEA	Best Available Technology Economically Achievable
BCPCT	Best Conventional Pollutant Control Technology
BESEP	Base Electronic System Engineering Plan
BHP	Brake Horsepower
BI	Black Iron
BIA	Brick Institute of America
BIL	Basic Impulse Insulation Level
BKRS	Breakers
BLDG	Building
BOCA	Building Official Code Association
BOD	Biochemical Oxygen Demand
	Building Research Advisory Board (now Building Research Board)
BRB	Building Research Board
BRG	Bearing
BTU	British Thermal Unit
°C	Degrees Centigrade (Celsius)
C&GS	U.S. Coast and Geodetic Survey (now National Geodetic Survey)
C M	Clean Air Act
CAMS	Continuous Air Monitoring System
CAS	Condition Assessment Survey
CCTV	Closed Circuit Television
CDR	Conceptual Design Report
CEM	Continuous Emissions Monitoring
CERC	U.S. Army Coastal Engineering Research Center
CERCLA	Comprehensive Environmental Response, Compensation, & Liability Act
CF	Cubic Feet
CFC	Chlorofluorocarbon
CFM	Cubic Feet per Minute
CFR	Code of Federal Regulations
CGA	Compressed Gas Association
CHW	Chilled Water
CI	Cast Iron
CIP	Cast-in-Place, Cast Iron Pipe
CISCA	Ceiling and Interior Systems Contractors Association
CISPI	Cast Iron Soil Pipe Institute
CMP	Corrugated Metal Pipe
CO_2	Carbon Dioxide
COE	U.S. Army Corps of Engineers
COMPR	Compressor
COP	Coefficient of Performance
CP	Concrete Pipe
CPLG	Coupling
CPSC	Consumer Product Safety Commission
CPVC	Chlorinated Polyvinyl Chloride
CRI	Carpet and Rug Institute
CRT	Cathode Ray Tube
C_v	Flow coefficient
c w	Cold Water
CWA	Clean Water Act

APPENDIX A

CYL	Cylinder
DAC	Derived Air Concentration
DARCOM	U.S. Army Development, Acquisition and Readiness Command
DB	Dry Bulb, Decibel
DBA	Design Basis Accident
DBE	Design Basis Earthquake
DBF	Design Basis Fire
DBFL	Design Basis Flood
DBG	Distance Between Guides
DBT	Design Basis Tornado
DBW	Design Basis Wind
DC	Direct Current
DCG	Derived Concentration Guide
DCPA	Defense Civil Preparedness Agency
DL	Dead Load
DM	NAVFAC Design Manual
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOP	Dioctylphthalate
DOT	U.S. Department of Transportation
DP	Differential Pressure
DP-1	Assistant Secretary for Defense Programs
DP-34	Director of Safeguards and Security Agreement
DPDT	Double-Pole Double-Throw
DSC	Differential Scanning Calorimetry
DTA	Differential Thermal Analysis
DWT	Double Wrap Traction
DWV	Drain, Waste &Vent
DX	Direct Expansion
DYN	Dyne
EA	Each
ECC	Emergency Control Center
ECP	Entry Control Point
EMCS	Energy Monitoring and Control System
ECS	Emergency Control Station
EDE	Effective Dose Equivalent
EED	Electroexplosive Device
EIA	Electronics Industries Association
EIFS	Exterior Insulation and Finish System
EIMA	Exterior Insulation Manufacturers Association
EIS	Environmental Impact Statement
Elev	Elevator
EM	U.S. Army Engineering Manual
EMS	Energy Management System
EMT	Electrical Metallic Tubing
EO	Executive Order
EOC	Emergency Operating Center
EPA	U.S. Environmental Protection Agency
EPS	Emergency Power System
Equip	Equipment
ERDA	Energy Research and Development Administration (precursor to DOE)
ESF	Engineered Safety Feature

APPENDIX A

Est	Estimated
Ext	Exterior
°F	Degrees Fahrenheit
F M	Federal Aviation Administration
FAI	Fauske and Associates, Inc.
FAR	Federal Acquisition Regulation
FCC	Federal Construction Council
FEMA	Federal Emergency Management Agency
FGA	Flat Glass Marketing Association
FGCC	Federal Geodetic Control Committee
FGD	Flue Gas Desulphurization
FHWA	Federal Highway Administration
FHDA	Fir and Hemlock Door Association
Fig	Figure
FIPS	Federal information Processing Standards
Fixt	Fixture
Flr	Floor
FM	Factory Mutual
Fndtn	Foundation
FPM	Feet Per Minute
FPT	Female Pipe Thread
FR	Federal Register
fr	Frame
FS	Federal Specifications
FSAR	Final Safety Analysis Report
Ft	Foot, feet
Ft/lb	Foot-Pound
FWPCA	Federal Water Pollution Control Act
fy	Yield strength
G	Gauss
g	Gram
GA	Gypsum Association
ga	Gauge
Gal	Gallon
Galv	Galvanized
GDC	General Design Criteria, DOE 6430.1A
GPD	Gallon Per Day
GPH	Gallon Per Hour
GPM	Gallons Per Minute
GSA	General Services Administration
HE	High Explosives
HE-Pu	High Explosives-Plutonium
HF	High Frequency, Hydrogen Fluoride
HI	Hydraulic Institute
HID	High Intensity Discharge
HLW	High-Level Waste
HOA	Hand-Off-Automatic
HP	Horsepower
HR	Hour
Htg	Heating
Htr	Heater
HTW	High Temperature Water

APPENDIX A

HVAC	Heating, Ventilating, and Air-Conditioning
Hvy	Heavy
HW	Hot Water
Hyd	Hydraulic
HX	Heat Exchanger
HZ	Hertz, frequency
IAPMO	International Association of Plumbing and Mechanical Officials
IAS	Intrusion Alarm System
ICBO	International Conference of Building Officials
ICRP	International Commission on Radiological Protection
ID	Inside Diameter
IDA	Intrusion Detection and Assessment
IDS	Intrusion Detection System
IEEE	Institute of Electrical and Electronic Engineers
IES	Illumination Engineering Society
IFM	Irradiated Fissile Material
IFMSF	Irradiated Fissile Material Storage Facility
IHE	Insensitive High Explosives
IMC	Intermediate Metal Conduit
In	Inch
Incl	Installed, Including
Inst	Installation
Insul	Insullation
IP	Iron Pipe
IPS	Iron Pipe Size
IPT	Iron Pipe Threaded
ISDSI	Insulated Steel Door Systems Institute
IU	Inspection Unit
IUEC	International Union of Elevator Contractors
J	Joule
°K	Degrees Kelvin
K	Subgrade modulus, Thousand, heavy wall copper tubing
Kg	Kilogram
kHz	Kilohertz
Kip	1000 pounds
Km	Kilometer
kPa	kilo Pascal
KV	Kilovolt
kVA	kiloVolt Ampere
kW	kilowatt
kWh	kilowatt hour
lb	Pound
lb/hr	Pounds Per Hour
lbf	Pounds Per Foot
LCC	Life-Cycle Cost
LCD	Liquid Crystal Display
LF	Linear Feet
LL	Live load psf - pounds per square foot
LLW	Low-Level Waste
LP	Liquid Petroleum, Low Pressure
LPG	Liquified Petroleum Gas
Lt	tight

APPENDIX A

LV	Low Voltage
MA	Management and Administration (U.S. DOE)
mA	milliAmpre
MAA	Material Access Area
Mach	Machine
Maint	Maintenance
MAWP	Maximum Allowable Working Pressure
MBA	Material Balance Area
MBH	Thousand BTUs per Hour
MBMA	Metal Building Manufacturers' Association
MC&A	Material Control and Accountability
MCF	Thousand Cubic Feet
Mfg	Manufacturing
Mfr	Manufacturer
MCC	Motor Control Center
mg	Milligram
mg/l	Milligrams per liter
MGPH	Thousand Gallons Per Hour
Mhz	Megahertz
MI	Miles, total level route
MIL-HDBK	U.S. DOD military handbook
MIN	Minute
min	Minimum
Misc	Miscellaneous
ml	Millileter
ML/SFA	Metal Lath/Steel Framing Association
mm	Millimeter
M&O	Management and Operations
MPH	Miles Per Hour
MPT	Male Pipe Thread
mr/h	milli roentgen/hour
mrad/h	milli roentgen, absorbed dose/hour
mrem	milli roentgen equivalent man
MSSA	Master Safeguards and Security Agreement
Mtng	Mounting
MVA	Million-Volt-Amps
N_2	Nitrogen
N/A	Not Applicable
NAAMM	National Association of Architectural Metal Manufacturers
NACE	National Association of Corrosion Engineers
NAD	North American Datum
NAEC	National Association of Elevator Contractors
NAESA	National Association of Elevator Safety Authorities
NAPHCC	National Association of Plumbing-Heating-Cooling Contractors
NASA	National Aeronautics and Space Administration
NAVFAC	Naval Facilities Engineering Command
NBC	National Building Code
NBS	National Bureau of Standards
NC	Noise Criteria
NCEL	Naval Civil Engineering Laboratory (references listed under NAVFAC)
NCMA	National Concrete Masonry Association
NDA	Non-Destructive Assay

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NEC	National Electrical Code
NEII	National Elevator Industry Incorporated
NEMA	National Electrical Manufacturers Association
NEMI	National Elevator Manufacturing Industry, inc. (now NEII)
NEPA	National Environmental Policy Act
NFGS	Naval Facilities Guide Specification (references listed under NAVFAC)
NFPA	National Fire Protection Association
NGS	National Geodetic Survey (formerly U.S.Coast and Geodetic Survey)
NGVD	National Geodetic Vertical Datum
NHPA	National Historic Preservation Act
NIJ	National Institute of Justice
NIST	National Institute of Standards and Technology (see NBS)
N O M	National Oceanic and Atmospheric Administration
NO	Normally Open
NO_x	Oxides of Nitrogen
NPDES	National Pollutant Discharge Elimination System
NPDWS	National Primary Drinking Water Standards
NPSH	Net Positive Suction Head
NPT	National Pipe Thread
NRC	Nuclear Regulatory Commission
NRCA	National Roofing Contractors Association
NRTA	Near-Real-Time Accountancy
NRTL	Nationally Recognized Testing Laboratory
NSA	National Security Agency
NSPC	National Standard Plumbing Code
NSPS	New Source Performance Standards
NTIA	National Telecommunications and Information Administration
NTMA	National Terrazzo and Mosaic Association
NUREG	Nuclear Regulatory Commission-produced reference document
NWWDA	National Wood Window and Door Association
OA	Outside Air
OBA	Operating Basis Accident
OBE	Operating Basis Earthquake
o c	On Center
OCS	Office of Computer Services (U.S. DOE)
OD	Outside Dimension
ODH	Oxygen Deficiency Hazards
O & M	Operations and Maintenance
OMB	Office of Management and Budget
OP AMP	Operational Amplifier
Oper	Operator
OPFM	Office of Project and Facilities Management (U.S. DOE)
OS&Y	Outside Screw and Yoke
OSHA	Occupational Safety and Health Administration
OSR	Operational Safety Requirement
o s s	Office of Safeguards and Security (U.S. DOE)
OSTI	Office of Scientific and Technical Information (U.S. DOE)
OWG	Oil, Water, or Gas
OS	Ounce
p	Minimum reinforcing ratio
PA	Protected area
PB	Polybutylene

APPENDIX A

PCB	Polychlorinated biphenyls
PCI	Prestressed Concrete institute
PEL	Permissible Exposure Limit
PF	Protection Factor
Ph	Phase
PI	Point of Intersection, Proportional-plus Integral
PIV	Post Indicator Valve
PLF	Pounds per Linear Foot
Pkg	Package
PMFL	Probable Maximum Flood
POL	Petroleum, Oil, and Lubricants
POTW	Publicly-Owned Treatment Works
PPHF	Plutonium Processing and Handling Facility
PPM	Parts Per Million
PRV	Pressure Regulating Valve
PSAR	Preliminary Safety Analysis Report
PSF	Plutonium Storage Facility, Pound-force per square foot
PSI	Pound-force per square inch
PSIA	Pounds per square inch absolute
PSIG	Pound-force per square inch gauge
PTI	Post Tensioning Institute
Pu	Plutonium
PUBN	Publication
PURPA	Public Utility Regulatory Policy Act
PVC	Polyvinyl Chloride
QA	Quality Assurance
Qty	Quantity
R	Resistance
R12, R22	Refigerant (12,22, etc.)
°R	Degrees Rankine
RCP	Reinforced Concrete Pipe
RCRA	Resource Conservation and Recovery Act
RDF	Refuse-Derived Fuel
REM	Roentgen Equivalent Man
Reqd	Required
RFCI	Resilient Floor Covering Institute
RG	Regulatory Guide
RLWF	Radioactive Liquid Waste Facility
RPFM	Real Property and Facilities Management (U.S. DOE)
RPIS	Real Property Inventory System (U.S. DOE)
RPM	Revolutions Per Minute
RSWF	Radioactive Solid Waste Facility
RTD	Resistance Temperature Detector
S&S	Safeguards and Security
SAR	Safety Analysis Report
SARS	Safety Analysis and Review System
SAS	Secondary Alarm Station
SC	Safety Class
SCFM	Standard Cubic Feet per Minute
SCR	Sillicon Control Rectifier
scs	U.S. Department of Agriculture, Soil Conservation Service
SDI	Steel Deck Institute, Steel Door Institute

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SDWA	Safe Drinking Water Act
SF	Safety Factor
SGFT	Structural Glazed Facing Tile
SISL	Special Isotope Separation Laser
SJI	Steel Joist Institute
SMA	Screen Manufacturers Association
SYACNA	Sheet Metal and Air Conditioning Contractors National Association
SNG	Supplementary Natural Gas
SNM	Special Nuclear Materials
SD*	Sulfur dioxide
SOP	Standard Operating Procedure
SP	Special Publication (of the American Concrete Association)
SPCC	Spill Prevention Control and Countermeasure
SPDT	Single-Pole Double-Throw
SPRI	Single Ply Roofing Institute
SPST	Single-Pole Single-Throw
ssco	Single Speed Center-Opening
SQFT	Square foot
SSE	Safe Shutdown Earthquake
SSFI	Scaffolding, Shoring, and Framing Institute
SSSP	Site Safeguards and Security Plan
SSPC	Steel Structures Painting Council.
ssss	Single Speed Side-Sliding
STC	Sound Transmission Classification
Std	Standard
STP	Standard Temperature and Pressure
Sys	System
SWI	Steel Window Institute
SWP	Safe Working Pressure
SWT	Single Wrap Traction
T	Ton, Temperature
TCA	Tile Council of America, Inc.
TCDD	Tetrachlorodibenzo-p-dioxin
TDS	Total Dissolved Solids
TEC	Total Estimated Cost
TID	Tamper Indicating Device
TIMA	Thermal Insulation Manufacturers Association
TLV	Threshold Limit Value
TM	U.S. Army technical manual
tot	Total
TR	DOD technical report
Transf	Transformer
TRU	Transuranic
TSCA	Toxic Substances Control Act
TSD	Treatment, Storage and Disposal
Tstat	Thermostat
TYP	Typical
TV	Television
U value	Overall heat transfer coefficient value
UBC	Uniform Building Code
UCRF	Uranium Conversion and Recovery Facility
UEF	Uranium Enrichment Facility

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UEU	Unirradiated Enriched Uranium
UEUSF	Unirradiated Enriched Uranium Storage Facility
UF_4	Uranium tetrafluoride
UF_6	Uranium hexafiuoride
UFAS	Uniform Federal Accessibility Standards
UHF	Ultra High Frequency
UL	Underwriters Laboratory
UMC	Uniform Mechanical Code
UO_2	Uranium dioxide
UO_3	Uranium trioxide
UPA	Unit Process Area
UPC	Uniform Plumbing Code
UPHF	Uranium Processing and Handling Facility
UPS	Uninterruptible Power Supply
URF	Uranium Recovery Facility
USC	U.S. Code
USCE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
USPHS	U.S. Public Health Service
USPS	U.S. Postal Service
V	Volt
VA	Volt-Ampere
Vac	Vacuum
VAV	Variable Air Volume
VCT	Vinyl Composition Floor Tile
Vel	Velocity
Vent	Ventilating
VHF	Very High Frequency
Vol	Volume
W	Watt
WB	Wet Bulb
WBT	Wet Bulb Temperature
WC	Water Column
WG	Water Gauge
WB	Wet Bulb
WBS	Work Breakdown Structure
WPCF	Water Pollution Control Federation
WRC	Water Resources Council
Yd	Yard
Yr	Year

APPENDIX A

SYMBOLS

°R'	Degrees Rankine
°K	Degrees Kelvin
°F	Degrees Fahrenheit
°C	Degrees Centigrade (Celcius)
>	Greater Than
<	Less Than
≥	Greater Than or Equal To
≤	Less Than or Equal To
%	Percent
#	Pound, Number
α, Α	Alpha
β, Β	Beta
ϕ, Φ	Theta
λ, Λ	Lambda
μ, Μ	Mu
π, Π	Pi
σ, Σ	Sigma
ω, Ω	Omega

APPENDIX A

END OF SUBSECTION

APPENDIX B

GLOSSARY

4-Pipe System:	Includes independent chilled water and hot water supply and return piping in closed loops, connecting the boilers and chillers to the terminal heat transfer units.
Absolute Humidity:	Amount of moisture in the air, indicated in grains per cubic foot.
Absolute Pressure:	Gauge pressure plus atmospheric pressure (14.7 lb per in^2)
Absolute Zero Temperature:	Temperature at which all molecular motion ceases (-460°F and -273.16°C).
Absorbent:	Substance which has the ability to take up or absorb another substance.
Absorber:	A device containing liquid for absorbing refrigerant vapor or other vapors. In an absorption system, that part of the low-side used for absorbing refrigerant vapor.
Absorption Chiller:	Heat operated refrigeration system that uses an absorbent (such as lithium bromide) as a secondary fluid to absorb the primary fluid (water), which is a gaseous refrigerant in the evaporator. The evaporative process absorbs heat, cooling the refrigerant (water), which cools the chilled water circulating through the heat exchanger.
Accelerate:	To add to speed; hasten progress of development.
Accelerator:	A device which speeds the operation of a dry pipe valve by channeling air, or nitrogen, from the sprinkler system piping to the intermediate chamber of the dry pipe valve.
Accepted:	A boiler unit, equipment, or device is accepted when listed, labeled, or otherwise determined to be suitable and safe by nationally recognized testing agency. Field installations are accepted when approved by the authority having jurisdiction.
Accessible:	Having access thereto but which first may require the removal of an access panel, door, or similar obstruction.
Accident:	(Explosive.) An incident or occurrence that results in an uncontrolled chemical reaction involving explosives.
Accumulator:	Storage tank which receives liquid refrigerant from vaporator and prevents it from flowing into suction line.
Acid Condition in System:	Condition in which refrigerant or oil in system is mixed with fluids which are acid in nature.
Acoustic Lining:	Insulating material secured to the inside of ducts to attenuate sound and provide thermal insulation.
Acoustical Duct Lining:	Duct with a lining designed to control or absorb sound and prevent transmission of sound from one room to another.
ACR Tubing:	Tubing used in refrigeration which has ends sealed to keep tubing clean and dry.

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Activated Alumina:	Chemical used as a dryer or desiccant.
Activated Carbon:	Specially processed carbon used as a filter-dryer; commonly used to clean air.
Actuator:	A controlled motor that can effect a change in the controlled variable (temperature, pressure) by operating a control element such as a valve or damper.
Adiabatic Compression:	Compressing refrigerant gas without removing or adding heat.
Adjust:	To regulate the specified fluid flow rate and air patterns at the terminal equipment (eg., reduce fan speed, throttling).
Adsorbent:	Substance which has property to hold molecules of fluids without causing a chemical or physical change.
Agitator:	Device used to cause motion in confined fluid.
Air (dry):	Mixture of dry gases present in the atmosphere.
Air (saturated):	A mixture of dry air and saturated water vapor all at the same dry-bulb temperature.
Air (specific heat of):	The quantity of heat absorbed by a unit weight of air per unit temperature rise.
Air (standard):	Air with a density of 0.075 Ibs per ft^3 and an absolute viscosity of 0.0379 x 10-5 lb mass per (ft) (sec). This is substantially equivalent to dry air at 70°F and 29.9 in. Hg barometric pressure.
Air Binding or Air Bound:	A condition in which a bubble or other pocket of air is present in a pipeline or item of equipment and, by its presence, prevents or reduces the desired flow or movement of the liquid or gas in the pipeline or equipment.
Air Break	(Drainage System.) A piping arrangement in which a drain from a fixture, appliance, or device discharges indirectly into a fixture, receptor, or interceptor at a point below the flood level rim of the receptor.
Air Changes:	A method of expressing the amount of air leakage into or out of a building or room in terms of the number of building volumes or room volumes exchanged.
Air Cleaner:	Device used for removal of airborne impurities
Air Coil:	Coil used with some types of heat pumps which may be used either as an evaporator or as a condenser.
Air Conditioner:	Device used to control temperature, humidity, cleanliness, and movement of air in conditioned space.
Air Cooler:	Mechanism designed to lower temperature of air passing through it.

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Air Cushion Tank:	A closed tank, generally located above the boiler and connected to a hydronic system in such a manner that when the system is initially filled with water, air is trapped within the tank. When the water in the system is heated it expands and compresses the air trapped within the air cushion tank, thus providing space for the extra volume of water without creating excessive pressure. Also called expansion tank.
Air Cycle, Air-Conditioning:	System which removes heat from air and transfers this heat to air.
Air Density, Standard:	Air at density of 0.075 lbm/ft^3
Air Density:	Mass of air per unit volume.
Air Diffuser:	Air distribution outlet designed to direct airflow into desired patterns.
Air Flow, Mass:	Mass of dry air flowing through tower for reducing circulating water temperature.
Air Flow Volume:	Volume of air mixture flowing through the tower tor reducing circulating water temperature.
Air Gap:	The unobstructed vertical distance through the free atmosphere between the outlet of the waste pipe (water supply) and the flood rim of the receptor into which it is discharging.
Air Handling Units (AHU):	The equipment which contains a fan or fans for moving air through a building which has a forced air ventilating system. Fans may be shut down by the fire system during an alarm.
Air Maintenance Device:	A device used to constantly maintain a specified air pressure in a dry pipe sprinkler system.
Air Return:	Air returned from conditioned or refrigerated space.
Air Sensing Thermostat:	Thermostat unit in which sensing element is located in refrigerated space.
Air Shutter:	An adjustable shutter on the primary air openings of a burner, which is used to control the amount of combustion air introduced into the burner body.
Air Vent:	Valve installed at the high points in a hot water system to permit the elimination of air from the system.
Air Washer:	Device used to clean air, which may increase or decrease humidity.
Air-Conditioning:	The simultaneous control of all, or at least the first three, of the following factors affecting the physical and chemical conditions of the atmosphere within a structure: Temperature, humidity, motion, distribution, dust, bacteria, odors, toxic gases, and ionization - most of which affect in greater or lesser degree human health or comfort.

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Air-Cooled Condenser:	Heat of compression is transferred from condensing coils to surrounding air. This may be done either by convection or by a fan or blower.
Air-Gas Ratio:	The ratio of combustion air supply flow rate to the fuel gas supply flow rate.
Alarm:	An audible or visible signal indicating an off-standard or abnormal condition.
Alarm Circuit:	A circuit that includes an alarm.
Alcohol Brine:	Water and alcohol solution which remains a liquid at below 32°F.
Aldehyde:	A class of compounds, which can be produced during incomplete combustion of a fuel gas. They have a pungent, distinct odor.
Alpha-Numeric Display:	A type of display, often used at an alarm receiver console, which uses alphabetic characters (letters) and numbers to convey information.
Altitude Adjustment:	Adjusting refrigerator controls so unit will operate efficiently at altitude in which it is to be used.
Altitude Valve:	A valve actuated (opened) by pressure loss usually due to the height of liquid in a tank.
Ambient Temperature:	The temperature of the air in the area of study or consideration.
Ambient Temperature:	The temperature of the outdoor air; temperature of the surrounding atmosphere.
Ambient:	Surrounding environmental conditions.
Ammeter:	An electric meter used to measure current, calibrated in Amperes.
Ammonia:	Chemical combination of nitrogen and hydrogen (NH3). Ammonia refrigerant is identified by R-l 17.
Amperage:	Electron or current flow of one coulomb per second past given point in circuit.
Ampere:	Unit of electric current equivalent to flow of one coulomb per second.
Amplifier:	Electrical device which increases electron flow in a circuit.
Anemometer:	Instrument for measuring the rate of flow of air.
Anhydrous Calcium Sulfate:	Dry chemical made of calcium, sulphur, and oxygen ($CaS0_4$).
Annealing:	Process of heat treating metal to obtain desired properties of softness and ductility (easy to form into new shape).
Annunciator:	A device which indicates a condition, either normal or abnormal, by visual signals, audible signals, or both.

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Anode:	Positive terminal of electrolytic cell.
Anticipating Control:	One which is artificially forced to cut in or cut out before it otherwise would, thus starting the cooling before needed or stopping the heating before control point is reached, to reduce the temperature fluctuation or override.
Approach:	Difference between cold water temperature and entering wet-bulb temperature.
Approved Equipment:	Equipment which has been accepted by the authority having jurisdiction. One frequent criterion for approval is that the equipment must be listed by Underwriters' Laboratories (UL) or approved by Factory Mutual (FM)_
Aspect Ratio:	Ratio of length to width of rectangular air grille or duct.
Aspirating Psychrometer:	A device which draws sample of air through it for humidity measurement purposes.
Aspiration:	The process of introducing a liquid or gas into a flowing stream by suction.
Atmospheric Burner:	(See Burner.)
Atmospheric Pressure:	Pressure that gases in air exert upon the earth; measured in pounds per square inch.
Atomize:	Process of changing a liquid to minute particles, or a fine spray.
Atomizing Media:	A supplementary medium, such as steam or air, that assists in breaking the fuel oil into a fine spray.
Attenuate	Decrease or lessen in intensity.
Automatic Expansion Valve (AEV):	Pressure controlled valve which reduces high-pressure liquid refrigerant to low-pressure liquid refrigerant.
Automatic Fire Alarm System:	A system using fire detectors, such as heat, smoke, and flame detectors to automatically initiate alarms.
Automatic Gas Pilot Device:	Gas pilot incorporating a device, which acts to automatically shut off the gas supply to the appliance burner if the pilot flame is extinguished.
Autotransformer:	Transformer in which both primary and secondary coils have turns in common. Step-up or step-down of Voltage is accomplished by taps on common winding.
Auxiliarized Alarm System:	A building alarm system connected to transmit fire alarm signals to the base alarm headquarters through a municipal type base alarm system.
Available Head:	The difference in pressure which can be used to circulate water in the system. The difference in pressure which may be used to overcome friction within the system. (See Pump Head, Head.)

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Axial Fans:	Fans that produce pressure from a change in velocity passing through the impeller, with no pressure being produced by centrifugal force.
Azeotropic Mixture:	Example of azeotropic mixture- refrigerant R-502 is mixture consisting of 48.8º refrigerant R-22, and 51º R-l 15. The refrigerants do not combine chemically, yet azeotropic mixture provides refrigerant characteristics desired.
Back Pressure:	Pressure in low-side of refrigerating system: also called suction pressure or low-side pressure.
Backfire Protection:	(See Flashback Arrestor.)
Backflow:	The flow of water or other liquids, 'mixtures, or substances into the distributing pipes of a potable supply of water from any source or sources other than its intended source.
Backflow Preventer:	A device or means to prevent backflow.
Baffle:	Plate or vane used to direct or control movement of fluid or air within confined area. A surface used for deflecting fluids, usually in the form of a plate or wall.
Balance:	To proportion flows within the distribution system (submains, branches, and terminals) according to specified design quantities.
Balance Fitting:	Pipe fitting or valve designed so that its resistance to flow may be varied. These are used to balance the pressure drop in parallel circuits.
Balance Point:	The outdoor temperature at which the output of the heat pump in a specific application is equal to.
Balancing Damper:	A plate or adjustable vane installed in a duct branch to regulate the flow of air in the duct.
Balancing Fit:	(See Balance Fitting.)
Balancing Valve:	(See Balance Fitting.)
Ball Check Valve:	Valve assembly call which permits flow of fluid in one section only.
Balloon Type Gasket:	Flexible refrigerator door gasket having a large cross section.
Barometer:	Instrument for measuring atmospheric pressure. It may be calibrated in pounds per square inch or in inches of mercury in column.
Baseboard:	A terminal unit resembling the base trim of a house. These units are the most popular terminal unit for residential systems.
Basin:	An open structure located beneath the tower fill for collecting the circulating water.
Basin Curb:	The top elevation of the tower basin. Usually the datum from which tower elevations are measured.

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Bath:	A liquid solution used for cleaning, plating, or maintaining a specified temperature.
Baudelot Cooler:	Heat exchanger in which water flows by gravity over the outside of the tubes or plates.
Bearing:	Low friction device for supporting and aligning a moving part.
Bellows:	Corrugated cylindrical container which moves as pressures change, or provides a seal during movement of parts.
Bending Spring:	Coil spring which is mounted on inside or outside to keep tube from collapsing while bending it.
Bimetal Strip:	Temperature regulating or indicating device which works on principle that two dissimilar metals with unequal expansion rates, welded together, will bend as temperatures change.
Blast Heater:	A set of heat-transfer coils or sections used to heat air which is drawn or forced through it by a fan.
Bleed tine:	A line used to relieve pressure to the atmosphere, either manually or automatically.
Bleed-Valve:	Valve with small opening inside which permits a minimum fluid flow when valve is closed.
Blow (Throw):	The distance an air stream travels from an outlet to a position at which air motion along the axis is reduced to a velocity of 50 ft. per minute.
Blowdown:	Water discharged from the system to control the concentration of salts or other impurities in the circulating water.
Blower:	A fan used to force air under pressure.
Boiler:	Closed vessel in which water is heated, steam is generated, steam is superheated, or any combination thereof, under pressure or vacuum by the direct application of heat. The term boiler shall include fired units for heating or vaporizing liquids other than water where these systems are complete within themselves.
Boiler, Automatically Fired:	A boiler which cycles automatically in response to a control system.
Boiler, High Pressure:	A boiler in which steam or vapor is generated at a pressure exceeding 15 psig (103.4 kPa gauge).
Boiler, Hot-Water Heating:	A boiler in which no steam is generated and from which hot water is circulated for heating purposes, then returned to the boiler.
Boiler, Hot-Water Supply:	A boiler that furnishes hot water to be used externally to itself at pressure not exceeding 160 psig (1100 kPa gauge) or a temperature not exceeding 250°F (120°C) at or near the boiler outlet.

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Boiler, Low-pressure:	A boiler in which steam or vapor is generated at a pressure not exceeding 15 psig (103.4 kPa gauge).
Boiler, Miniature:	A boiler that does not exceed any of the following limits: 16 in. (406.4 mm) inside diameter of shell; 20 sq ft. (1.86 m2) heating surface; 5 cu ft. (0.142 m3) gross volume, exclusive of casing and insulation; 100 psig (689.5 kPa gauge) maximum allowable working pressure.
Boiler Blowoff Tank:	A vessel designed to receive the discharge from a boiler blow-off outlet and to cool the discharge to a temperature which permits its safe discharge to the drainage system.
Boiler Blowoff:	An outlet on a boiler to permit emptying or discharge of sediment.
Boiler Economizer:	The last pass of boiler tubes or a heat exchanger located in the flue pipe that extracts some of the heat from the flue gases before they are vented to the atmosphere.
Boiler Heating:	That part of a hydronic heating system in which heat is transferred from the fuel to the water. If steam is generated it is a steam boiler. If the temperature of the water is raised without boiling, it is classed as a hot water boiler.
Boiler Horsepower:	The equivalent evaporation of 34.5 lb of water per hr from and at 212°F. This is equal to a heat output of 970.3 x 34.5 = 33,475 BTU/hr.
Boiler Manufacturer:	An organization that manufactures pressure parts for boilers or that shop-assembles parts into completed boilers.
Boiler System:	A system comprised of the boiler(s), its controls, safety devices, and interconnected piping, vessels, valves, fittings, and pumps.
Boiler Unit:	A complete assembly comprised of the boiler, the apparatus used to produce heat, and associated controls and safety devices.
Boiling Temperature:	Temperature at which a fluid changes from a liquid to a gas.
Bonnet:	The part of the furnace casing which forms a plenum chamber from where supply ducts receive warmed air. Also called supply plenum. The upper part of a fire hydrant which may be removed for maintenance of the operating stem.
Bore:	Inside diameter of a cylindrical hole.
Bourdon lube:	As used in pressure gauges. Thin walled tube of elastic metal flattened and bent into circular shape, which tends to straighten as pressure inside is increased.
Bowden Cable:	Tube containing a wire used to regulate a valve or control from a remote point.
Bowl Assembly:	The vertical pipe extending down into the water supply which contains the impellers of a vertical turbine fire pump.

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Boyle's Law:	Law of physics-volume of a gas varies as pressure varies, if temperature remains the same. Examples: If pressure is doubled on quantity of gas, volume becomes one half. If volume becomes doubled, gas has its pressure reduced by one half.
Branch:	(1) The outlet or inlet of a fitting that is not in line with the run and takes off at an angle to the run (eg., tees, wyes, crosses, laterals, etc.) (2) Duct or pipe serving a single terminal.
Branch Circuit:	That portion of the wiring system between the final overcurrent device protecting the circuit and the utilization equipment.
Branch Main:	Duct or pipe serving two or more terminals.
Brazing:	Method of joining metals with nonferrous tiller (without iron) using heat between 800°F and melting point of base metals.
Breaker Strip:	Strip of wood or plastic used to cover joint between outside case and inside liner of refrigerator.
Brine:	Water saturated with chemical such as salt.
BTU (British Thermal Unit):	A quantity of heat required to raise the temperature of 1 lb (0.45 kg) of water 1°F (0.56°C).
BTUH:	A unit of power equal to one British thermal unit/hr.
Building:	A structure having walls and a roof designed and used for the housing, shelter, enclosure, or support of persons, animals, or property.
Building Drain:	That part of the lowest piping of a drainage system which receives the discharge from soil, waste, and other drainage pipes inside the walls of the building and conveys it to the building sewer beginning 3 feet outside of the building wall.
Building Sewer:	That part of the drainage system which extends from the end of the building drain and conveys its discharge to a public sewer, private sewer, individual sewage disposal system, or other point of disposal.
Building Storm Drain:	A building drain which conveys storm water or other drainage, but not sewage.
Building Storm Sewer:	A building sewer which conveys storm water or other drainage, but not sewage.
Building Trap:	A device, fitting, or assembly of fittings installed in the building drain to prevent recirculation of air between the drainage system of the building and the building sewer.
Bulb, Sensitive:	Part of sealed fluid device which reacts to temperature to be measured, or which will control a mechanism.

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Bull Head: The installation of a pipe tee in such a way that water enters (or leaves) the tee at both ends of the run (the straight through section of the tee) and leaves (or enters) through the side connection only.

Bunker: In commercial installations, space in which ice or cooling element is installed.

Bunsen-Type Burner: A gas burner in which combustion air is injected into the burner by the gas jet emerging from the gas orifice and this air is premixed with the gas supply within the burner body before the gas burns on the burner port.

Burner: A device for the final conveyance of. gas, or a mixture of gas and air, to the combustion zone. (See also specific type of burner): (1) Injection Burner. A burner employing the energy of a jet of gas to inject air for combustion into the burner and mix it with gas. (a) Atmospheric Injection Burner. A burner in which the air injected into the burner by a jet of gas is supplied to the burner at atmospheric pressure. (2) Power Burner. (See also Forced Draft Burner, Induced Draft Burner, Premixing Burner, and Pressure Burner). A burner in which either gas or air or both are supplied at pressure exceeding, for gas. the line pressure, and for air, atmospheric pressure. (3) Yellow-Flame Burner. A burner in which secondary air only is depended on for the combustion of the gas.

Burner, Atmospheric: A gas burner in which air for combustion is supplied by natural draft, the inspirating force being created by gas velocity through the orifices.

Burner, Natural Draft Type: A burner that depends primarily on the natural draft created in the flue to induce the air required for combustion into the burner.

Burner, Power: A burner in which all air for combustion is supplied by a power driven fan that overcomes the resistance through the burner.

Burner Assembly: A burner that is factory-built as a single assembly or as two or more subassemblies that include all essential parts necessary for its normal function when installed as intended.

Burner Aexibility: The degree at which a burner can operate with reasonable characteristics with a variety of fuel gases and/or variations in input rate (g;15 pressure).

Burner Head: That portion of a burner beyond the outlet of the mixer tube which contains the burner ports.

Burner Port: (See Port.)

Burning Speed: (See Flame Velocity.)

Butane: A hydrocarbon fuel gas heavier than methane and propane and a major constituent of liquefied petroleum gases.

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Butterfly Valve:	A device which regulates the flow of a liquid by a plate which pivots in the waterway.
Bypass:	Passage at one side of, or around regular passage.
Cabinet Units:	Small air handling units that house an air filter, heating coil, and a centrifugal blower.
Cadmium Plated:	Parts coated with thin corrosion resistant covering of cadmium metal.
Calcium Sulfate:	Chemical compound (CaS04) which is used as a drying agent or desiccant in liquid line dryers.
Calibrate:	To determine position indicators . as required to obtain accurate measurements.
Calorie:	Heat required to raise temperature of one gram of water one degree centigrade.
Calorimeter:	Device for measuring heat quantities, such as machine capacity, heat of combustion, specific heat, vital heat, heat leakage, etc. Also device for measuring quality (or moisture content) of steam or other vapor.
Capacitance (C):	Property of nonconductor (condenser or capacitor) that permits storage of electrical energy in an electrostatic field.
Capacitor:	Type of electrical storage device used in starting and/or running circuits on many electric motors.
Capacitor-Start Motor:	Motor which has a capacitor in the starting circuit.
Capacity, Refrigerating:	The ability of a refrigerating system, or part thereof, to remove heat expressed as a rate of heat removal, usually measured in BTU/hr or tons/24 hr.
Capacity Reducer:	In a compressor a device such as a clearance pocket or movable cylinder head.
Capillary Tube:	A type of refrigerant control. Usually consists of several feet of tubing having a small inside diameter. Friction of liquid refrigerant and bubbles of vaporized refrigerant within tube serve to restrict flow so that correct high-side and low-side pressures are maintained while the compressor is operating. A capillary tube refrigerant control allows high-side and low-side pressures to balance during off-cycle. Also, a small diameter tubing used to connect temperature control bulbs to control mechanisms.
Carbon Dioxide (CO_2):	Compound of carbon and oxygen which is sometimes used as a refrigerant. Refrigerant number is R-744. A gas used for fire extinguishing purposes.
Carbon Filter:	Air filter using activated carbon as air cleansing agent.

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Camot Cycle:	A sequence of operations forming the reversible working cycle of an ideal heat engine of maximum thermal efficiency. It consists of isothermal expansion, adiabatic expansion, isothermal compression, and adiabatic compression to the initial state.
Carrene:	A refrigerant in group I (R-l 1). Chemical combination of carbon, chlorine, and fluorine.
Cascade System:	One having two or more refrigerant circuits, each with a pressure imposing element, condenser, and evaporator, where the evaporator of one circuit cools the condenser of the other (lower-temperature) circuit.
Case Hardened:	Heat treating ferrous metals (iron) so surface layer is harder than interior.
Cathode:	Negative terminal of an electrical device. Electrons leave the device at this terminal.
Cathode Ray lube (CRT):	A vacuum tube in which a hot cathode emits electrons that are accelerated as a beam through a high Voltage anode, focused or deflected electrostatically or electromagnetically and allowed to fall on a fluorescent screen. Often used as a display or readout device for computers and similar applications.
Cell:	The smallest subdivision of a tower, bounded by exterior wall(s) and/or partitions, which can function as an independent unit.
Celsius:	German language word for centigrade, the metric system temperature scale.
Centigrade Scale:	Temperature scale used in metric system. Freezing point of water is 0; boiling point 100.
Centimeter:	Metric unit of linear measurement which equals .3937 in.
Central Fan System:	A mechanical indirect system of heating, ventilating, or air-conditioning, in which the air is treated or handled by equipment located outside the rooms served (usually at a central location) and is conveyed to and from the rooms by means of a fan and a system of distributing ducts.
Central Systems:	Systems composed of prime movers that convert energy (in the form of heating or cooling) from fuel or electricity. They are located in a single area to serve distribution systems that deliver the heating or cooling to the conditioned space.
Centrifugal Chiller:	A gas compressor in which the compression is obtained by the means of centrifugal force, the force away from the center of a rapidly rotating impeller.
Centrifugal Compressor:	Compressor which compresses gaseous refrigerants by centrifugal force.
Charge:	The amount of refrigerant in a system.

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Charging:	Putting in a charge.
Charging Board:	Specially designed panel or cabinet fitted with gauges, valves, and refrigerant cylinders used for charging refrigerant and oil into refrigerating mechanisms.
Charles' Law:	The volume of a given mass of gas at a constant pressure varies according to its temperature.
Check Valve:	A device which permits a liquid or gas to flow in one direction only.
Chemical Refrigeration:	A system of cooling using a disposable refrigerant.
Chimney Effect:	The tendency of air or gas in a duct or other vertical passage to rise when heated due to its lower density compared with that of the surrounding air or gas. In buildings, the tendency toward displacement (caused by the difference in temperature) of internal heated air by unheated outside air due to the difference in density of outside and inside air.
Choke lube:	Throttling device used to maintain correct pressure difference between high-side and low-side in refrigerating mechanism. Capillary tubes are sometimes called choke tubes.
Circuit:	A tubing, piping, or electrical wire installation which permits flow from the energy source through the path and back to the energy source.
Circuit Main:	The portion of the main in a multiple circuit system that carries only a part of the total capacity of the system.
Circulating Water plow:	Quantity of hot water flowing into the tower to be cooled
Circulator:	A motor driven device used to mechanically circulate water in the system. Also called Pump.
Clapper:	The device inside of a water control valve which prevents water downstream of the valve from entering the upstream side.
Clearance:	Space in cylinder not occupied by piston at end of compression stroke, or volume of gas remaining in cylinder at same point. Measured in percentage of piston displacement.
Clearance Pocket Compressor:	A small space in cylinder from which compressed gas is not completely expelled. This space is called the compressor clearance space or pocket. For effective operation, compressors are designed to have as small a clearance space as possible.
Closed Cycle:	Any cycle in which the primary medium is always enclosed and repeats the same sequence of events.
Code Installation:	A refrigeration or air conditioning installation which conforms to the local code and/or the national code for safe and efficient installations.

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Coder:	Coding mechanism connected to ring bells in a distinctive pattern or to transmit a pulsating signal to a remote receiver. The pattern of pulses may give location or may instead identify type of detection device (waterflow, heat detector, manual) generating the signal. The coder may operate by mechanically opening and closing electrical contacts or electronic circuitry may cause relay contacts to generate the code.
Coefficient of Conductivity:	The measure of the relative rate at which different materials conduct heat. Copper is a good conductor of heat and therefore has a high coefficient of conductivity.
Coefficient of Expansion:	The change in length per unit length, or the change in volume per unit volume, per degree change in temperature.
Coefficient of Performance (COP):	The ratio of work or energy applied as compared to the energy used.
Coil:	Any heating or cooling element made of pipe or tubing connected in series.
Cold:	Cold is the absence of heat: a temperature considerably below normal.
Cold Junction:	That part of a thermoelectric system which absorbs heat as the system operates.
Cold Water Temperature:	Average temperature of water as it leaves the tower fill and enters the basin.
Colorimetric Detection Device:	A device for detecting the presence of a particular substance, such as carbon monoxide, in which the presence of that substance will cause a color change in a material in the detector.
Combined **Feeder/Cutoff:**	A device that regulates makeup water to a boiler in combination with a low-water fuel cutoff.
Combustible:	A material which is capable of being ignited or burned.
Combustion:	The rapid oxidation of fuel, producing heat or heat and light combustion air; the air required for combustion of the fuel. This does not include the air used for atomization.
Combustion Air:	Air supplied in an appliance specifically for the combustion of a fuel gas.
Combustion Chamber:	The portion of an appliance within which combustion normally occurs.
Combustion Products:	Constituents resulting from the combustion of a fuel gas with the oxygen in air, including the inerts, but excluding excess air.

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Comfort Air-Conditioning:	The simultaneous control of all, or at least the first three, of the following factors affecting the physical and chemical conditions of the atmosphere within a structure for the purpose of human comfort: temperature, humidity, motion, distribution, dust. bacteria, odors, toxic gases, and ionization, most of which affect in greater or lesser degree human health or comfort.
Comfort Chart:	Chart used in air-conditioning to show the dry bulb temperature and humidity for human comfort conditions.
Comfort Zone:	Area on psychometric chart which shows conditions of temperature, humidity, and sometimes air movement, in which most people are comfortable:
Command Functions:	Ability of an alarm system to control some functions of other building systems. For instance, when an alarm occurs, the alarm system may "command" fans to shut down or fire doors to close.
Commercial Buildings:	Such buildings as stores, shops, restaurants, motels, and large apartment buildings.
Commutator:	Part of electric motor rotor which conveys electric current to rotor windings.
Compound:	A distinct substance formed by the chemical combination of two or more elements in definite proportions.
Compound Gauge:	Instrument for measuring pressures both above and below atmospheric pressure.
Compound Refrigerating System:	System which has several compressors or compressor cylinders in series. The system is used to pump low-pressure vapors to condensing pressures.
Compression:	Term used to denote increase of pressure on a fluid by using mechanical energy.
Compression Gauge:	Instrument used to measure positive pressures (pressures above atmospheric pressure only). These gauges are usually calibrated from 0 to 300 pounds per square inch of pressure, gauge, (psig).
Compression Tank:	(See Air Cushion Tank.)
Compressor, Hermetic	Compressor in which driving motor is sealed in the same dome or housing that contains the compressor.
Compressor, Open-Type:	Compressor in which the crankshaft extends through the crankcase and is driven by an outside motor.
Compressor, Reciprocating:	Compressor which uses a piston and cylinder mechanism to provide pumping action.

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Compressor, Refrigerating:	The pump of a refrigerating mechanism which draws a vacuum or low-pressure on cooling side of refrigerant cycle and squeezes or compresses the gas into the high-pressure or condensing side of the cycle.
Compressor, Rotary:	A compressor which uses vanes, eccentric mechanisms, or other rotating devices to provide pumping action.
Compressor Seal:	Leakproof seal between crankshaft and compressor body.
Condensable:	A gas which can be easily converted to liquid form, usually by lowering the temperature and/or increasing pressure.
Condensate:	Fluid which forms on an evaporator.
Condensate Pump:	Device used to remove fluid condensate that collects beneath an evaporator.
Condensation:	Liquid or droplets which form when a gas or vapor is cooled below its dew point.
Condense:	Action of changing a gas or vapor to a liquid.
Condenser:	The heat exchanger in a refrigeration system that removes heat from the hot high-pressure refrigerant gas and transforms it into a liquid.
Condenser, Air-Cooled:	A heat exchanger which transfers heat to surrounding air.
Condenser, Water-Cooled:	Heat exchanger which is designed to transfer heat from hot gaseous refrigerant to water.
Condenser Comb:	Comb-like device, metal or plastic, which is used to straighten the metal fins on condensers or evaporators.
Condenser Fan:	Forced air device used to move air through air-cooled condenser.
Condenser Water System:	An open piping loop connecting the chillers to the cooling tower. Circulation is accomplished by means of parallel, constant volume pumps.
Condenser Water Pump:	Forced water moving device used to move water through condenser.
Condensing Unit:	That part of a refrigerating mechanism which pumps vaporized refrigerant from an evaporator, compresses it, liquefies it in the condenser and returns the liquid refrigerant to refrigerant control.
Condensing Unit Service Valves:	Shutoff hand valves mounted on condensing unit to enable serviceman to install and/or service unit.
Conductance (surface film):	The time rate of heat flow per unit area under steady conditions between a surface, and the ambient fluid for a unit temperature difference between the surface and the fluid. In English units its value is usually expressed in BTU per hour/square foot (Fahrenheit degree temperature difference between surface and fluid).

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Conductance (Thermal):	"C" factor. The time rate of heat flow per unit area under steady conditions through a body from one of its bounding surfaces to the other for a unit temperature difference between the two surfaces. In English units its value is usually expressed in BTU per (hour) (square foot) (Fahrenheit degree). The term is applied to specific bodies or constructions as used, either homogeneous or heterogeneous.
Conductivity (Thermal):	"K" factor. The time rate of heat flow through unit area of a homogeneous material under steady conditions when a unit temperature gradient is maintained in the direction perpendicular to the area. In English units its value is usually expressed in BTU per hour/square foot (Fahrenheit degree per inch of thickness). Materials are considered homogeneous when the value of "K" is not affected by variation in thickness or in size of sample within the range normally used in construction.
Conductor (Electrical):	A body that may be used to conduct electric current.
Conductor (Thermal):	A material which readily transmits heat by means of conduction.
Conductor (Piping):	A pipe inside the building which conveys storm water from the roof to a storm or combined building drain.
Conduit:	Tubing, usually metal or plastic, which protects wiring from damage.
Connected Load:	The total load in BTU/hr attached to the boiler. It is the sum of the outputs of all terminal units and all heat to be supplied by the boiler for process applications.
Connecting Rod:	That part of a compressor mechanism which connects the piston to crankshaft.
Constant Volume Reheat:	The volume of the supply air is unchanged, while the supply air temperature is raised as the local zone cooling load decreases.
Constrictor:	Tube or orifice used to restrict flow of a gas or a liquid.
Contactor:	An electrical device similar to a relay used for controlling heavy electrical equipment remotely. A contactor contains a coil and usually several sets of contacts for switching power on or off in response to energizing or deenergizing the coil.
Contacts:	Metallic surfaces usually of precious metal, or plated with precious metal, used for switching electrical current off and on in relays, contactors, and in switches. Contacts are used in sets or pairs. Two contacts are required to open or close an electrical circuit.
Contaminant:	A substance (dirt, moisture, etc.) foreign to refrigerant or refrigerant oil in system.

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Continuity:	An electrical condition in which there is no interruption between two points. Continuity is usually checked with an ohmmeter or the resistance measuring scale of a multimeter. If there is continuity, the resistance measured is less than infinite.
Continuous Cycle Absorption System:	System which has a continuous flow of energy input.
Continuous Duty:	the design feature of an electrical device, such as a motor, enabling the device to operate at the rated load for an indefinite period.
Control:	Automatic or manual device used to stop, start, and/or regulate flow of gas, liquid, and/or electricity.
Control, Low Pressure:	Cycling device connected to low-pressure side of system.
Control, Motor:	A temperature or pressure operated device used to control running of motor.
Control, pressure Motor:	A high- or low-pressure control which is connected into the electrical circuit and used to start and stop motor when there is need for refrigeration or for safety purposes.
Control, Refrigerant:	Device used to regulate flow of liquid refrigerant into evaporator, such as capillary tube, expansion valves, high- and low-side float valves.
Control, Temperature:	A thermostatic device which automatically stops and starts motor, operation of which is based on temperature changes.
Control, Operating:	An automatic control, other than a safety control, to start or regulate input according to demand, and to stop or regulate input on satisfaction of demand.
Control, Primary Safety:	A control directly responsive to flame properties, sensing the presence of flame and in event of ignition failure or loss of flame, causing shutdown.
Control Valve:	A valve which permits the regulation of a certain piece of equipment, eg. sprinkler riser control valve.
Controlled Evaporator Pressure:	Controlled system which maintains definite pressure or range of pressures in evaporator.
Convection, Forced:	Transfer of heat resulting from forced movement of liquid or gas by means of fan or pump.
Convection, Natural:	Circulation of a gas or liquid due to difference in density resulting from temperature differences.
Convection:	The movement of a fluid set up by a combination of differences in density and the force of gravity, eg., warm water at the bottom of a vertical tank will rise and displace cooler water at the top, cooler water will sink to the bottom as the result of its greater density.

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Convector:	A terminal unit surrounded on all sides by an enclosure having an air outlet at the top or upper front. Convectors operate by gravity recirculated room air.
Converter:	A heat exchange unit designed to transfer heat from one distributing system to another. These may be either steam-to-water or water-to-water units. They are usually of shell and tube design.
Cooling Plant:	The machinery that produces chilled water or cool refrigerant gas (chiller or compressor), the condenser, cooling tower, and condenser water pumps for water cooled plants, air cooled condensers for air cooled systems, and chilled water pumps and expansion tanks for chilled water systems.
Cooling lower:	A device for cooling by evaporation. A natural draft cooling tower is one where the air flow through the tower is due to its natural draft chimney effect. A mechanical draft tower employs fans to force or induce a draft.
Copper Plating:	Condition developing in some units in which copper is electrolytically deposited on compressor part surfaces.
Corrosivity:	The tendency of a metal to wear away another metal by chemical attack.
Counterflow:	In heat exchange between two fluids, opposite direction of flow, coldest portion of one meeting coldest portion of the other.
Counterflow Tower:	A type of tower in which the air and water streams are in countercurrent flow.
Crank Throw:	Distance between center line of main bearing journal and center line of the crank pin or eccentric.
Crankshaft Seal:	Leakproof joint between crankshaft and compressor body.
Critical Pressure:	Condition of refrigerant at which liquid and gas have same properties.
Critical Temperature:	Temperature at which vapor and liquid have same properties.
Critical Vibration:	Vibration which is noticeable and harmful to structure.
Cross Charged:	Sealed container containing two fluids which together create a desired pressure-temperature curve.
Crossf low lower:	A type of tower in which the air and water streams are in crosscurrent flow.
Cryogenic Fluid:	Substance which exists as a liquid or gas at ultra-low temperatures (-50°F or lower).
Cryogenics:	Refrigeration which deals with producing temperatures of 50°F below zero and lower.

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Cubic Foot of Gas (Standard Conditions):	The amount of gas which will occupy 1 cubic foot when at a temperature of 60°F, and under a pressure equivalent to that of 30 in. of mercury.
Current:	A flow of electric charge. The amount of electric charge flowing past a point per unit time measured in amperes.
Cut-In:	Temperature or pressure valve which closes control circuit.
Cut-out:	Temperature or pressure valve which opens control circuit.
Cycle:	Series of events which have tendency to repeat same events in same order.
Cylinder, Refrigerant:	Cylinder in which refrigerant is purchased and dispensed. Color code painted on cylinder indicates kind of refrigerant cylinder contains.
Cylinder Head:	Part which encloses compression end of compressor cylinder.
Cylinder Unloader:	Automatic devices used to hold open the reciprocating compressor valves of a number of cylinders to reduce compressor pumping capacity.
Cylindrical Commutator:	Commutator with contact surfaces parallel to the rotor shaft.
Dalton's law:	Vapor pressure exerted on container by a mixture of gases is equal to sum of individual vapor pressures of gases contained in mixture.
Damper:	A valve or plate which is installed in the cold and warm air ductwork and used to regulate the amount of air flowing through the duct. A damper may also be used in the flue of a furnace.
Dashpot:	A damping device, used to delay movement. A piston moves in a cylinder and a trapped liquid or gas is allowed to leave the trapped space at a controlled rate through a hole in the piston or by another route. An air dashpot is frequently used in water-flow detection devices to delay the signal and eliminate false signals due to water pressure surges.
Data Gathering Panel (DGP):	Equipment used in multiplex systems as the connecting point for initiating circuits and other building alarm equipment. The DGP communicates with the main alarm console by transmitting status information when interrogated, also known as interface panel.
Dead Space:	The short distance between a burner port and the base of a flame.
Decibel:	Unit used for measuring relative loudness of sounds. One decibel is equal to approximate difference of loudness ordinarily detectable by human ear, the range of which is about 130 decibels on scale beginning with one for faintest audible sound.

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Desnergite: The removal of electrical power from an electrically operated device such as a relay or contactor.

Deflection: Movement from a normal position. When applied to the indicator needle of a meter, it means the movement of the needle from its normal position.

Defrosting Type Evaporator: An evaporator operating at such temperatures that ice and frost on surface melts during off part of operating cycle.

Degreasing: Solution or solvent used to remove oil or grease from refrigerator parts.

Degree-Day: Unit that represents one degree of difference from reference point in average outdoor temperature of one day and is often used in estimating fuel requirements for a building. Degree-days are based on average temperature over a 24 hour period. As an example, if an average temperature for a day is 50°F, the number of degree-days for that day would be equal to 65°F minus 50°F or 15 degree-days (65-50 = 15). Degree-days are useful when calculating requirements for heating purposes.

Dehumidifier: Device used to remove moisture from air in enclosed space.

Dehumidifier (Surface): An air-conditioning unit designed primarily for cooling and dehumidifying air through the action of passing the air over wet cooling coils.

Dehumidify: To remove water vapor from the atmosphere. To remove water or liquid from stored goods.

Dehumidifying Effect: The difference between the moisture contents, in pounds per hour, of the entering and leaving air multiplied by 1.060.

Dehydrate: To remove water in all forms from matter. Liquid water, hygroscopic water, and water of crystallization, or water of hydration are included.

Dehydrated Oil: Lubricant which has had most of water content removed (a dry oil).

Dehydrator: (See Dryer.)

Dehydrator-Receiver: A small tank which serves as liquid refrigerant reservoir and which also contains a desiccant to remove moisture. Used on most automobile air conditioning installations.

Deice Control: Device used to operate refrigerating system in such a way as to provide melting of the accumulated ice and frost.

Delta Transformer: A three-phase electrical transformer which has ends of each of three windings electrically connected.

Deluge System: A sprinkler system in which water discharges from open sprinklers at the same time.

Demand Meter: An instrument used to measure kilowatt-hour consumption of a particular circuit or group of circuits.

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Density:	The weight of a substance per unit volume. As applied to gases, the weight in pounds of a cubic foot of gas at standard pressure and temperature.
Deodorizer:	Device which absorbs various odors, usually by principle of absorption. Activated charcoal is a common substance used.
Desiccant:	Substance used to collect and hold moisture in refrigerating system. A drying agent. Common desiccants are activated alumina silica gel.
Design Heat Loss:	The heat loss of a building or room at design indoor-outdoor temperature difference.
Design Load:	The design heat loss plus all other heating requirements to be provided by the boiler.
Design Temperature Difference:	The difference between the design indoor and outdoor temperatures.
Design Water Temperature:	The average of the temperature of the water entering and leaving the boiler (or sub-circuit) when the system is operating at design conditions.
Design Water Temperature Drop:	The difference between the temperature of the water leaving the boiler and returning to the boiler when the system is operating at design conditions. In large systems employing subcircuits, the design temperature drop is usually taken as the difference in the temperature of the water entering and leaving each sub-circuit.
Detector, Leak:	Device used to detect and locate refrigerant leaks.
Detector Check Valve:	A device which measures incidental flows of water to a fire protection system and prevents reverse flows. Large flows are unmetered. Device used for controlling fluid flow.
Dew Point:	Temperature at which vapor (at 100 percent humidity) begins to condense and deposit as liquid.
Diagnosis:	Analysis of physical or electrical symptoms to determine condition.
Diaphragm:	Flexible membrane usually made of thin metal, rubber, or plastic.
Diaphragm Valve:	A valve which is operated by pressure on one side of a membrane or diaphragm inside the valve and restricts flow through the valve in relationship to the pressure applied.
Dichlorodifluoromethane:	Refrigerant commonly known as R-12. Chemical formula is CC12F2. Cylinder color code is white. Boiling point at atmospheric pressure is -21.62°F.
Die Cast:	A process of molding low melting temperature metals in accurately shaped metal molds.
Die Stock:	Tool used to hold dies with external threads.

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Dielectric Fluid:	Fluid with high electrical resistance.
Dielectric:	A nonconductor of electricity; an insulator or insulating material.
Dies (Thread):	Tool used to cut external threads.
Differential:	As applied to refrigeration and heating: difference between cut-in and cut-out temperature or pressure of a control.
Diffuser:	A circular, square, or rectangular air distribution outlet, generally located in the ceiling and comprised of deflecting members to discharge supply air in various directions.
Dilution Air:	Air which enters a draft hood and mixes with the flue gases.
Diode:	An electric device that restricts current flow chiefly to one direction, usually a semiconductor device.
Direct Expansion (DX):	Refrigeration systems that employ expansion valves or capillary tubes to meter liquid refrigerant into the evaporator.
Direct Expansion Evaporator:	An evaporator coil using either an automatic expansion valve (AEV) or a thermostatic expansion valve (TEV) refrigerant control.
Direct Return:	A two-pipe system in which the first terminal unit taken off the supply main is the first unit connected to the return main.
Direct-Indirect Heating Unit:	A heating unit located in the room or space to be heated and partially enclosed, the enclosed portion being used to heat air which enters from outside the room.
Discharge Coefficient:	The ratio of the actual flow rate of a gas from an orifice or port to the theoretical, calculated flow rate. Always less than 1 .0.
Dispatcher:	One who dispatches or sends out vehicles.
Displacement, piston:	Volume obtained by multiplying area of cylinder bore by length of piston stroke.
Distillation:	Removal of gaseous substances from solids or liquids by applying heat.
Distilling Apparatus:	Fluid reclaiming device used to reclaim used refrigerants. Reclaiming is usually done by vaporizing and then re-condensing refrigerant.
Distribution System:	A system of conduits, orifices, weirs, or nozzles for receiving the circulating water entering the tower and distributing it over the area where it is in contact with air.
Domestic Hot Water:	The heated water used for domestic or household purposes such as laundry, dishes, bathing, etc.
Domestic Sewage:	The water borne waste derived from ordinary living processes.
Door Closer:	A device used to close a door for the purpose of limiting the spread of smoke or fire.

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Double Heat Transfer:	The transfer of heat from the plant to the heated medium (usually liquid) and from the liquid to the air in the conditioned space.
Double Thickness Flare:	Copper, aluminum, or steel tubing end which has been formed into two-wall thickness, 37 to 45 deg. bell mouth or flare.
Down-Feed One-Pipe Riser (Steam):	A pipe which carries steam downward to the heating units and into which condensate drains from the heating units.
Down-feed System (Steam):	A steam heating system in which the supply mains are above the level of the heating units which they serve.
Down Feed System:	A Hydronic system in which the main is located above the level of the terminal units.
Downdraft:	Excessive high air pressure existing at the outlet of chimney or stack which tends to make gases flow downward in the stack.
Downstream:	In the direction in which the water is flowing.
Draft:	A current of air, usually referring to the difference in pressure which causes air or gases to flow through a chimney flue, heating unit, or space.
Draft Gauge:	Instrument used to measure air movement.
Draft Hood (Draft Diverter):	A device built into an appliance, or made part of a vent connector from an appliance which is designed to: (1) assure the ready escape of the products of combustion in the event of no draft, backdraft, or stoppage beyond the draft hood; (2) prevent a backdraft from entering the appliance; and (3) neutralize the effect of stack action of a chimney or gas vent upon the operation of the appliance.
Draft Indicator:	An instrument used to indicate or measure chimney draft or combustion gas movement. Draft is measured in units of in. of water column.
Drain Cock:	A valve installed in the lowest point of a boiler or at low points of a heating system to provide for complete drainage of water from the system.
Drainage System:	Includes all the piping, within public or private premises, which conveys sewage, rain water, or other liquid wastes to the point of disposal. It does not include the mains of a public sewer system or private or public sewage-treatment.
Dryer:	A substance or device used to remove moisture from a refrigeration system.
Drift:	Circulating water lost from the tower in the form of fine droplets entrained in the exhaust air.

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Drift Eliminator:	Device(s) to minimize drift. Baffles in a cooling tower or air handler through which air passes before exiting to remove entrained water droplets from the exhaust air.
Drift:	The entrained unevaporated water carried from a cooling tower by the air moving through the tower.
Drilled Port Burner:	A burner in which the ports have been formed by drilled holes in a thick section in the burner head or by a manufacturing method which results in holes similar in size, shape, and depth.
Drip Leg:	The container placed at a low point in a system of piping to collect condensate and from which condensate may be removed.
Drip Pan:	Pan-shaped panel or trough used to collect condensate from evaporator coil.
Dry Barrel Fire Hydrant:	A fire hydrant which is controlled by a valve located at the base of a fire hydrant below the frost line.
Dry Bulb:	An instrument with sensitive element which measures ambient (moving) air temperature.
Dry Bulb Temperature:	Air temperature as indicated by ordinary thermometer.
Dry Circuit:	A circuit powered by low DC Voltage, frequently characterized by switch contact resistance problems.
Dry Ice:	A refrigerating substance made of solid carbon dioxide which changes directly from a solid to a gas (sublimates). Its subliming temperature is 109°F below zero.
Dry Pipe System:	A sprinkler system which normally contains pressurized air or nitrogen instead of water.
Duct:	Round or rectangular sheet metal pipes through which heat is carried from the furnace to the various rooms in the building.
Duct Static Pressure:	The pressure acting on the walls of a duct; the total pressure less the velocity pressure; the pressure existing by virtue of the air density and its degree of compression.
Dust:	An air suspension (aerosol) of particles of any solid material, usually with particle size less than 100 microns.
DWV:	An acronym for “drain-waste-vent” referring to the combined sanitary drainage and venting systems.
Dynamometer:	Device for measuring power output or power input of a mechanism.
Eccentric:	A circle or disk mounted off-center. Eccentrics are used to adjust controls and connect compressor drive shafts to pistons.

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Eccentric Reducer:	A pipe fitting designed to change from one pipe size to another and to keep one edge of both pipes in line. These fittings should be installed so that the in-line section of pipe is at the top.
Economizer Cycle:	A system of dampers, temperature and humidity sensors, and actuators which maximizes the use of outdoor air for cooling.
Eductor:	A device used to introduce foam liquid concentrate into a water stream.
Effective Area:	Actual flow area of an air inlet or outlet. Gross area minus area of vanes or grille bars.
Effective Heat Allowance:	An allowance added to the test output of certain designs of radiation to compensate for a better distribution of heat within the heated space. Some agencies do not permit the use of effective heat allowance.
Effective Temperature:	Overall effect on a human of air temperature, humidity, and air movement.
Effective Temperature Difference:	The difference between the room air temperature and the supply air temperature at the outlet to the room.
Effluent:	Treated waste water or airborne emissions discharged into the environment.
Ejector:	Device which uses high fluid velocity such as a venturi, to create low-pressure or vacuum at its throat to draw in fluid from another source.
Electomagnetit:	Refers to a device containing an electromagnet consisting of a soft core wound with a current carrying coil of insulated wire.
Electric Heating:	House heating system in which heat from electrical resistance units is used to heat rooms.
Electric Heating Element:	A unit assembly consisting of a resistor, insulated supports, and terminals for connecting the resistor to electric power.
Electric Water Valve:	Solenoid type (electrically operated) valve used to turn water flow on and off.
Electronic Leak Detector:	Electronic instrument which measures electronic flow across gas gap. Electronic flow changes indicates presence of refrigerant gas molecules.
Electronic Sound Tracer:	Instrument used to detect leaks by locating source of high frequency sound caused by leaks.
Electrostatic Filter:	Type of filter which gives particles of dust electric charge. This causes particles to be attracted to plate so they can be removed from air stream or atmosphere.
End Bell:	End structure of electric motor which usually holds motor bearings.

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End Play:	Slight movement of shaft along center line.
Energize:	Apply electrical power to an electrically operated device such as a relay or contactor.
Entering Wet-Bulb Temperature:	Wet-bulb temperature of air temperature entering the tower; includes any effect of recirculation and/or interference.
Enthalpy:	Total amount of heat in one pound of a substance calculated from accepted temperature base. Temperature of 32°F is accepted base for water vapor calculation. For refrigerator calculations, accepted base is 40°F.
Entropy:	Mathematical factor used in engineering calculations. Energy in a system.
Enzyme:	A complex organic substance originating from living cells that speeds up chemical changes in foods. Enzyme action is slowed by cooling.
Epoxy (Resins):	A synthetic plastic adhesive.
Equalizer lube:	Device used to maintain equal pressure or equal liquid levels between two containers.
Eutectit Mixture or Solution:	A mixture which melts or freezes completely at constant temperature and with constant composition. Its melting point is the lowest possible for mixtures of the given substances.
Evacuation Alarm:	An alarm to warn occupants of an area to leave the area.
Evaporation:	Water evaporated from the circulating water into the atmosphere during the cooling process. It is independent of drift.
Evaporative Condenser:	A device which uses open spray or spill water to cool a condenser. Evaporation of some of the water cools the condenser water and reduces water consumption.
Evaporator:	The heat exchanger in a refrigeration system that removes heat from the media being cooled (air or chilled water). It takes low-pressure, low temperature refrigerant liquid and transforms it into a gas.
Evaporator, Dry Type:	An evaporator into which refrigerant is fed from a pressure reducing device. Little or no liquid refrigerant collects in the evaporator.
Evaporator, Flooded:	An evaporator containing liquid refrigerant at all times.
Evaporator Coil:	Device made of a coil of tubing which functions as a refrigerant evaporator.
Evaporator Fan:	Fan which cools extended heat exchange surface of evaporator.

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Excess Air:	Air which passes through an appliance and the appliance flues in excess of that required for complete combustion of the gas. Usually expressed as a percentage of the air required for complete combustion of the gas.
Exfiltration:	Air flow outward through a wall, leak, membrane, etc.
Exhaust Air:	The mixture of dry air and water vapor leaving the tower.
Exhaust Opening:	Any opening through which air is removed from a space which is being heated or cooled, humidified or dehumidified, or ventilated.
Exhauster:	A device which speeds the operation of a dry pipe valve by allowing a larger volume of air to escape through itself than could escape through a sprinkler.
Exit Basin Temperature:	Temperature of circulating water as it leaves the cold water collecting basin.
Expansion Joint:	A joint whose primary purpose is to absorb the longitudinal expansion and contraction in the line due to temperature changes.
Expansion Loop:	A large radius loop in a pipe line which absorbs the longitudinal expansion and contraction in the line due to temperature changes.
Expansion Tank:	A device to control pressure in a hydraulic system by storing excess volume resulting from increased operating temperatures.
Expansion Valve:	A device in a refrigerating system which maintains a pressure difference between the high-side and low-side and is operated by pressure.
Expellent Gas:	A pressurized gas, usually nitrogen which is used to agitate and permeate dry chemical to make it fluid.
Extended Surface:	Heat transfer surface, one side of which is increased in area by the use of fins, ribs, pins, etc.
External Corrosion:	Corrosion of that portion of a metal structure (pipe) that is exposed to external elements such as air, water, or soil.
External Equalizer:	Tube connected to low-pressure side of an expansion valve diaphragm and to exit of evaporator.
Facilities:	(1) Buildings and other structures, their functional systems and equipment, and other fixed systems and equipment installed therein; outside plant, including site development features such as landscaping, roads, walks, and parking areas; outside lighting and communication systems; central utility plants; utilities supply and distribution systems; and other physical plant features. As used in these criteria, the term “nuclear facilities” is synonymous with this same term as contained in DOE 5480.5.

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Fahrenheit:	The common scale of temperature measurement in the English system of units. It is based on the freezing point of water being 32°F and the boiling point of water being 212°F at standard pressure conditions.
Fail Safe Control:	Device which opens circuit when sensing element fails to operate.
False Alarm:	An alarm produced by a malfunction.
Fan:	A radial or axial flow device used for moving or producing artificial currents of air.
Fan (Centrifugal):	A fan rotor or wheel within a scroll type of housing including driving mechanism supports for either belt drive or direct connection.
Fan (Propeller):	A propeller or disc-type wheel within a mounting ring or plate including driving mechanism supports for either belt drive or direct connection.
Fan (lube axial):	A propeller or disc-type wheel within a cylinder including driving mechanism supports for either belt drive or direct connection.
Fan (Vane Axial):	A disc-type wheel within a cylinder, a set of air guide vanes located either before or after the wheel including driving mechanism supports for either belt drive or direct connection.
Fan Coil Unit:	An air handling unit that houses an air filter, heating or cooling coil, drain pan, and centrifugal fan, and operates by moving air through an opening in the unit and across the coils.
Fan Shutdown:	A stoppage of a fan in an air handling unit (AHU) caused by a false alarm.
Fault:	An electrical defect in a circuit of an alarm system
Ferrous:	As used in this course, ferrous relates to objects made of iron or steel.
Field Pole:	Part of stator of motor which concentrates magnetic field of field winding.
Fill:	Devices placed in the tower for the purpose of facilitating direct contact between circulating water and air.
Filter:	Device for removing small particles from a fluid or air/gas. A porous material (fiberglass or foam plastic) which is installed in the air circulation system of a furnace to remove dust particles and pollen. Some are disposable, whereas some may be cleaned and re-used.
Filtering:	Removing unwanted electrical signals by using an electrical or electronic signal.
Fin:	An extended surface to increase the heat transfer area, as metal sheets attached to tubes.

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Finned-lube:	A heat exchange device consisting of a metal tube through which water or steam may be circulated. Metal plates or fins are attached to the outside of the tube to increase the heat transfer surface. Finned tube or fin tube, may consist of one, two, or three tiers and are designed for installation bare, or with open type grilles, covers, or enclosures having top, front, or inclined outlets. Usually finned-tube units are for use in other than residential buildings.
Fire Alarm Box:	An enclosure housing a transmitting device.
Fire Department Connection:	A connection through which a fire department can pump water into a sprinkler or standpipe system.
Fire Door:	A door intended to stop the progress of a fire.
Fire Pump Unit:	Assembled unit consisting of fire pump, driver, controller, and accessories.
Fire Pump:	Pump intended to supply water, at rated capacity and at total rated head, required for fire protection service.
Fire lube Boiler:	A steel boiler in which the hot gasses from combustion are circulated through tubes which are surrounded by boiler water which fills the space between the boiler shell and the tubes.
Firing Device:	The burner: either oil, gas, or coal.
Firing Rate:	The rate at which air, fuel, or an air-fuel mixture is supplied to a burner, expressed in volume or heat units supplied per unit of time.
Fixed Plate Heat Exchanger:	A static device that transfers sensible heat through plates separating a warm gas or fluid stream from a cold stream.
Flame Arrestor:	(See Flashback Arrestor.)
Flame Failure Response lime:	The time interval between the loss of flame and de-energizing the safety shutoff valve.
Flame Retention Device:	A device added to a burner which aids in holding the flame base close to the burner ports.
Flame Rollout:	A condition where flame rolls out of a combustion chamber when the burner is turned on.
Flame lest for Leaks:	Tool which is principally a torch and when an air-refrigerant mixture is fed to flame. this flame will change color in presence of heated copper.
Flame Velocity:	The speed at which a flame moves through a fuel-air mixture.
Flammability Limits:	The maximum percentages of a fuel in an air-fuel mixture which will burn.
Flapper Valve:	The type of valve used in refrigeration compressors which allows gaseous refrigerants to flow in only one direction.

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Flare:	Copper tubing is often connected to parts of refrigerating system by use of flared fittings. These fittings require that the tube end be expanded at about 45° angle. This flare is firmly gripped by fittings to make a strong leak proof seal.
Flash Boiler:	A boiler with very limited water capacity. Usually about one gallon of water per 1000 BTU/hr net rating.
Flash Gas:	This is the instantaneous evaporation of some liquid refrigerant in evaporator which cools remaining liquid refrigerant to desired evaporation temperature.
Flash Point:	Temperature at which an oil will give off sufficient vapor to support a flash flame but will not support continuous combustion.
Flash Weld:	A resistance type weld in which mating parts are brought together under considerable pressure and a heavy electrical current is passed through the joint to be welded.
Flashback:	An undesirable flame characteristic in which burner flames strike back into a burner to burn there or to create a pop after the gas supply has been turned off.
Flashback Arrestor:	A gauze, grid or any other portion of a burner assembly used to avert flashback.
Flashtube:	An ignition device, commonly used for igniting gas on range top burners. An air-gas mixture from the burner body is injected into the end of a short tube. The mixture moves along the tube, is ignited by a standing pilot flame at the other open end of the tube and the flame travels back through the mixture in the flashtube to ignite the gas at the burner ports.
Float Valve:	Type of valve which is operated by sphere or pan which floats on liquid surface and controls level of liquid.
Floating Flames:	An undesirable burner operating condition, usually indicating incomplete combustion in which flame leaves the burner ports to “reach” for combustion air.
Flood Level Rim:	The edge of the receptor from which water overflows.
Flooded System:	Type of refrigerating system in which liquid refrigerant fills evaporator.
Flooded System Low-Side Float:	Refrigerating system which has a low-side float refrigerant control.
Flooding:	Act of filling a space with a liquid.
Flow Control Valve:	A specially designed check valve usually, installed in the supply pipe, to prevent gravity circulation of hot water within the heating system when the pump is not in operation.
Flow Meter:	Instrument used to measure velocity or volume of fluid movement.

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Flow Pressure:	The pressure in the water supply pipe near the faucet or water outlet while the faucet or water outlet is fully open and flowing.
Flue:	An enclosed passage in the chimney to carry exhaust smoke and fumes of the heating plant to escape to the outer air.
Flue Gases, Flue products:	Products of combustion and excess air in appliance flues or heat exchangers before the draft hood.
Flue Loss:	The heat lost in flue products exiting from the flue outlet of all appliances.
Flue Outlet:	The opening provided in an appliance for the escape of flue gases.
Fluid Coupling:	Device which transmits drive energy to energy absorber through a fluid.
Flush:	An operation to remove any material or fluids from refrigeration system parts by purging them to the atmosphere using refrigerant or other fluids.
Flush Valve:	A device located at the bottom of a tank for flushing water closets and similar fixtures.
Flushometer Valve:	A device which discharges a predetermined quantity of water to fixtures for flushing purposes and is closed by direct water pressure or other mechanical means.
Flux, Magnetic:	Lines of force of a magnet.
Flux-Brazing, Soldering:	Substance applied to surfaces to be joined by brazing or soldering to free them from oxides and facilitate good joint.
Foam Leak Detector:	A system of soap bubbles or special foaming liquids brushed over joints and connections to locate leaks.
Foam Maker:	A device designed to introduce pressurized foam into a pressurized foam solution stream.
Foaming:	Formation of a foam in an oil-refrigerant mixture due to rapid evaporation of refrigerant dissolved in the oil. This is most likely to occur when the compressor starts and the pressure is suddenly reduced.
Foot of Water:	A measure of pressure. One foot of water is the pressure created by a column of water one foot in height. It is equivalent to 0.433 lb/in*.
Foot Pound:	A unit of work. A foot pound is the amount of work done in lifting one pound one foot. Force is accumulated pressure and is expressed in pounds. If the pressure is 10 psig on a plate of 10 sq. in. area, the force is 100 lbs.
Force-Feed Oiling:	A lubrication system which uses a pump to force oil to surfaces of moving parts.

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Forced Convection:	Movement of fluid by mechanical force such as fans or pumps.
Forced Draft:	Air movement from the fan discharge through the heat exchanger, cooling tower, or boiler.
Forced Draft Burner:	A burner in which combustion air is supplied by a fan or blower.
Forced Draft lower:	Type of mechanical draft tower in which the air moving device is located at the air inlet.
Forced Hot Water (Or Forced Circulation Hot Water):	Hot water heating system in which a pump is used to create the necessary flow of water.
Free Area:	The total minimum area of the openings in a grille, or register through which air can pass.
Free Cooling:	Cooling without the use of mechanical refrigeration.
Freeze-Up:	(1) The formation of ice in the refrigerant control device which may stop the flow of refrigerant into the evaporator. (2) Frost formation on a coil may stop the air-flow through the coil.
Freezing:	Change of state from liquid to solid.
Freezing Point:	The temperature at which a liquid will solidify upon removal of heat. The freezing temperature for water is 32°F at atmospheric pressure.
Freon:	Trade name for a family of synthetic chemical refrigerants manufactured by DuPont De Nemours Inc.
Friction Head:	In a hydronic system the friction head is the loss in pressure resulting from the flow of water in the piping system.
Frost Back:	Condition in which liquid refrigerant flows from evaporator into suction line; indicated by frost formation on suction line.
Frosting Type Evaporator:	A refrigerating system which maintains the evaporator at frosting temperatures during phases of cycle.
Fuel:	Any substance used for combustion.
Fuel Gas:	Any substance in a gaseous form when used for combustion.
Fuel-Oil Burner (Pressure Atomizing or Gun Type):	A burner designed to atomize the oil for combustion under an oil supply pressure of 100 psig.
Fuel Oil Burner (Vaporizing or Pot Type):	These burners use the heat of combustion to vaporize the oil in a pool beneath the vaporizing ring, and this vapor rising through the ring ignites and maintains combustion in the burner.
Fuel-Oil Burner (Rotary Type):	A burner employing a throw ring that mixes the oil and air.

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Full Floating:	A mechanism construction in which a shaft is free to turn in all the parts in which it is inserted.
Fumes:	Smoke; aromatic smoke; odor emitted, as of flowers; a smoky or vaporous exhalation, usually odorous, as that from concentrated nitric acid. The word fumes is so broad and inclusive that its usefulness as a technical term is very limited. Its principal definitive characteristic is that it implies an odor. The terms vapor, smoke, fog, etc., which can be more strictly defined, should be used whenever possible. Also defined as solid particles generated by condensation from the gaseous state, generally after volatilization from molten metals, etc., and often accompanied by a chemical reaction such as oxidation. Fumes flocculate and sometimes coalesce.
Furnace:	That part of a warm air heating system in which combustion takes place.
Fuse:	Electrical safety device consisting of strip of fusible metal in circuit which melts when current is overloaded.
Fusible Plug:	A plug or fitting mode with a metal of a known low melting temperature, used as safety device to release pressures in case of fire.
Galvanic Action:	Corrosion action between two metals of different electronic activity. The action is increased in the presence of moisture.
Galvanizing:	Coating iron or steel surfaces with a protective layer of zinc.
Gas:	One of the following fuel gases: natural gas, liquefied petroleum (LP) gas, LP air mixture, manufactured gas, or mixed gas.
Gas Distribution Piping:	A pipe within the building which conveys gas from the point of delivery to the points of usage.
Gas pressure Regulator:	A device for controlling and maintaining a predetermined gas pressure.
Gas Service piping:	The pipe from the gas main or other source of supply including the meter, regulating valve, or service valve to the gas distribution system of the building served.
Gas Valve:	Device for controlling flow of gas.
Gas-Noncondensible:	A gas which will not form into a liquid under pressure-temperature conditions.
Gasket, Foam:	A joint sealing device made of rubber or plastic foam strips.
Gasket:	A resilient or flexible material used between mating surfaces of refrigerating unit parts or of refrigerator doors to provide a leak proof seal.

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Gate Valve:	A valve designed in such a way that the opening for flow (when the valve is fully open) is essentially the same as the pipe and the direction of flow through the valve is in a straight line.
Gauge, Compound:	Instrument for measuring pressures both below and above atmospheric pressure.
Gauge, High pressure:	Instrument for measuring pressures in range of 0 psig to 500 psig.
Gauge, Low Pressure:	Instrument for measuring pressures in range of 0 psig and 50 psig.
Gauge, Vacuum:	Instrument used to measure pressures below atmospheric pressure.
Gauge Manifold:	A device constructed to hold compound and high-pressure gauges and valves to control flow of fluids through it.
Glycol:	Liquid with a very low freezing point that is miscible with water.
Grate Area:	Grate surface area measured in square feet, used in estimating the fuel burning rate.
Gravity (Specific):	The specific gravity of a solid or liquid is the ratio of the mass of the body to the mass of an equal volume of water at some standard temperature. At the present time a temperature of 4°C (39°F) is commonly used by physicists, but the engineer uses 60°F. The specific gravity of a gas is usually expressed in terms of dry air at the same temperature and pressure as the gas.
Gravity Hot Water:	Hot water heating systems in which the circulation of water through the system is due to the difference in the density of the water in the supply and return sides of the system.
Grille:	An ornamental or louvered opening placed at the end of an air passageway.
Grommet:	A plastic metal or rubber doughnut-shaped protector for wires or tubing as they pass through hole in object.
Gross Output:	A rating applied to boilers. It is the total quantity of heat which the boiler will deliver and at the same time meet all limitations of applicable testing and rating codes.
Ground:	A conducting connection to the earth or to a portion of an electric circuit that is at zero potential with respect to the earth.
Ground, Short Circuit:	A fault in an electrical circuit allowing electricity to flow into the metal parts of the structure.
Ground Coil:	A heat exchanger buried in the ground which may be used either as an evaporator or as a condenser.
Ground Wire:	An electrical wire which will safely conduct electricity from a structure into the ground.

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Grounded:	Connected to earth or to some conducting body that serves in place of the earth.
Grounded Conductor:	A system or circuit conductor that is intentionally grounded.
Grounding Conductor, Equipment:	The conductor used to connect non-current carrying metal parts of equipment, raceways, and other enclosures to the system grounded conductor at the service and/or the grounding electrode conductor.
Guarded:	Covered, shielded, fenced, enclosed, or otherwise protected by means of covers, casings, barriers, rails, screens, mats, or platforms to prevent contact by persons or objects.
Halide Refrigerants:	Family of refrigerants containing halogen chemicals.
Halide Torch:	Type of torch used to detect halogen refrigerant leaks.
Halon:	A term used to describe any one of several halogenated gaseous compounds. The term is followed by a four or five digit number to identify a specific gas.
Hard **Flame:**	A flame with a hot, tight, well-defined inner cone.
Head:	As used in this course, head refers to a pressure difference. See pressure head, pump head, available head.
Head, Static:	Pressure of fluid expressed in terms of column height of the fluid, such as water or mercury.
Head, Velocity:	In flowing fluid, height of fluid equivalent to its velocity pressure.
Head (Total):	In flowing fluid, the sum of the static and velocity pressures at the point of measurement.
Head Pressure:	Pressure which exists in condensing side of refrigerating system.
Head-Pressure Control:	Pressure operated control which opens electrical circuit if high-side pressure becomes excessive.
Header:	A piping arrangement for interconnecting two or more supply or return tappings of a boiler. Also a section of pipe, usually short in length, to which a number of branch circuits are attached.
Heat:	Form of energy the addition of which causes substances to rise in temperature; energy associated with random motion of molecules.
Heat, Sensible:	Heat that changes the temperature of a substance without changing its form.
Heat (Latent):	Heat characterized by a change of state of the substance concerned for a given pressure, and always at a constant temperature for a pure substance, i.e., heat of vaporization or of fusion.

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Heat (Specific):	The heat absorbed (or given up) by a unit mass of a substance when its temperature is increased (or decreased) by 1 degree.
Heat Exchanger:	Device used to transfer heat from a warm or hot surface to a cold or cooler surface. Evaporators and condensers are heat exchangers.
Heat Flow:	(See Heat Loss.)
Heat Lag:	When a substance is heated on one side, it takes time for the heat to travel through the substance. This time is called heat lag.
Heat Leakage:	Flow of heat through a substance is called heat leakage.
Heat Load:	Amount of heat, measured in BTU, which is removed during a period of 24 hours.
Heat Loss:	As used in this course, the term applies to the rate of heat transfer from a heated building to the outdoors.
Heat Loss Factor:	A number assigned to a material or construction indicating the rate of heat transmission through that material or construction for a one degree temperature difference.
Heat of Compression:	Mechanical energy of pressure transformed into energy of heat.
Heat of Fusion:	The heat released in changing a substance cfrom a liquid state to a solid state. The heat of fusion of ice is 144 BTU per pound.
Heat of Respiration:	The process by which oxygen and carbohydrates are assimilated by a substance; also when carbon dioxide and water are given off by a substance.
Heat pump:	A compression cycle system used to supply heat to a temperature controlled space, that can also remove heat from the same space.
Heat Transfer:	Movement of heat from one body or substance to another. Heat may be transferred by radiation conduction, convection, or a combination of these three methods.
Heat Transmission:	Any time-rate of heat flow; usually refers to conduction, convection, and radiation combined.
Heat Transmission Coefficient:	Any one of a number of coefficients used in calculating heat transmission through different materials and structures by conduction, convection, and radiation.
Heating Coil:	A heat transfer device which releases heat .
Heating Control:	Device which controls temperature of heat transfer unit which releases heat.

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Heating Effect Factor: An arbitrary allowance added to the test output of some types of terminal units when establishing the catalog ratings. This allowance is intended to give credit for improved heat distribution obtained from the terminal unit.

Heating Element (Electric): A unit assembly consisting of a resistor, insulated supports, and terminals for connecting the resistor to electric power.

Heating Surface: All surfaces which transmit heat from flames or flue gases to the medium being heated. Heating Unit (Electric).

Heating Value: Amount of heat which may be obtained by burning a fuel. It is usually expressed in BTU per pound or BTU per gallon.

Heavy Ends Hydrocarbon Oils: The heavy molecules or larger molecules of hydrocarbon oils.

Helical or Rotary Screw Type Compressor: Refrigeration compression achieved by trapping the refrigerant gas in the space formed by the flutes of meshing screws, reducing the gas volume, and compressing the gas.

Hermetic Motor: Compressor drive motor sealed within same casing which contains compressor.

Hermetic System: Refrigeration system which has a compressor driven by a motor contained in compressor dome or housing.

Hermetically Sealed Unit: A sealed hermetic-type condensing unit is a mechanical condensing unit in which the compressor and compressor motor are enclosed in the same housing with no external shaft or shaft seal, the compressor motor operating in the refrigerant atmosphere. The compressor and compressor motor housing may be of either the fully welded or brazed type, or of the service-sealed type. In the fully welded or brazed type, the housing is permanently sealed and is not provided with means of access for servicing internal parts in the field. In the service-sealed type, the housing is provided with some means of access for servicing internal parts in the field.

Hg (Mercury): Heavy silver-white metallic element; only metal that is liquid at ordinary room temperature. Symbol, Hg.

High-Temperature Water System (HTW): A hot water system operating at temperatures over 350°F and usual pressures of about 300 psi.

High Efficiency Particulate Air (Hepa) Filters: A high-efficiency particulate air filter having a fibrous media that produces a particle removal efficiency of at least 99.97% for 0.3-micrometer particles of dioctylphthalate (DOP) when tested in accordance with MIL-STD-282.

High Fire: The rate of a burner at or near design maximum fuel input.

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High Limit Control:	A switch controlled by the temperature of the water in the boiler and used to limit burner operation whenever the boiler water temperature reaches the maximum to be permitted. A safety control.
High Pressure Compressed Air Systems:	Systems operating at pressure greater than 200 psig.
High Pressure Cut-Out:	Electrical control switch operated by the high-side pressure which automatically opens electrical circuit if too high head pressure or condensing pressure is reached.
High Pressure Steam System:	One that operates above 15 psig (100 kPa above atmospheric).
High Side:	Parts of a refrigerating system which are under condensing or high-side pressure.
High Side Float:	Refrigerant control mechanism that controls the level of the liquid refrigerant in the high-pressure side of mechanism.
High Vacuum Pump:	Mechanism that can create vacuum in 1000 to 1 micron range.
High Voltage Controls:	Also called “line Voltage controls.” Controls designed to operate at normal line Voltage, usually 115 V.
Hollow-lube Gasket:	Sealing device made of rubber or plastic with tubular cross section.
Hone:	Fine-grit stone used for precision sharpening.
Horsepower:	A unit of power equal to 33,000 foot pounds of work per minute. One electrical horsepower equals 746 watts.
Hose Header:	A device used for testing pumps which consists of a manifold of two or more, depending on the size of the pump, 2 1/2 inch hose valves to which hoses with nozzles are attached. Various flow rates are achieved by opening the valves of the individual hoses.
Hot Gas Bypass:	Piping system in refrigerating unit which moves hot refrigerant gas from condenser into low-pressure side.
Hot Gas Defrost:	A defrosting system in which hot refrigerant gas from the high-side is directed through evaporator for a short period of time and at predetermined intervals in order to remove frost from evaporator.
Hot Junction:	That part of thermoelectric circuit that releases heat.
Hot Water Heating Systems:	Hydronic systems in which heated water is circulated through the terminal units.
Hot Water Temperature:	Weighted average temperature of circulating water entering the tower.

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Hot Water:	Hot water is supplied to plumbing fixtures at a temperature of not less than 120°F and not more than 140°F except that commercial dishwashing machines and similar equipment shall be provided with water at 180°F for sterilization purposes.
Hot Wire:	A resistance wire in an electrical relay which expands when heated and contracts when cooled.
Humidifiers:	Device used to add to and control the humidity in a confined space.
Humidistat:	An instrument that is used to regulate the operation of a humidifier to control the amount of humidity in the conditioned air.
Humidity, Absolute:	The amount of moisture actually in a given unit volume of air.
Humidity, Relative:	A ratio of the weight of moisture that air actually contains at a certain temperature as compared to the amount that it could contain if it were saturated.
Humidity:	Moisture; dampness. Relative humidity is a quantity ratio of vapor present in the air to greatest amount possible at given temperature.
Hydrometer:	Floating instrument used to measure specific gravity of a liquid. Specific gravity is ratio of weight of any volume of a substance to weight of equal volume of substance used as a standard.
Hydronic Piping System:	The 'water-side" of an air-and-water or all-water heating and air conditioning system. Hydronic piping systems include 4-pipe, hot and chilled water piping system, and condenser water piping system. These systems are classified by ASHRAE as Low-Water-Temperature, Forced, Recirculating systems.
Hygrometer:	An instrument used to measure degree of moisture in the atmosphere.
Hygroscopic:	Ability of a substance to absorb and retain moisture and change physical dimensions as its moisture content changes.
Ice Melting Equivalent **(I.M.E.)** (Ice Melting Effect):	Amount of heat absorbed by melting ice at 32°F is 144 BTU per pound of ice or 288,000 BTU per ton.
Idler:	A pulley used on some belt drives to provide the proper belt tension and to eliminate belt vibration.
Ignition:	The act of starting combustion.
Ignition System, Direct:	An automatic ignition system which uses an electrically energized device to ignite fuel at a main burner.
Ignition Temperature:	The minimum temperature at which combustion can be started.

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Ignition Transformer:	A transformer designed to provide a high Voltage current. Used in many heating systems to ignite fuel.
Ignition Velocity:	(See Flame Velocity.)
Impeller:	The rotating part in pump which increases the water supply pressure by centrifugal force.
Impingement Target Burner:	A burner consisting simply of a gas orifice and a target, with the gas jet from the orifice entraining combustion air in the open and the mixture striking and burning on the target surface. No usual burner body is used.
Inches of Mercury Column:	A unit used in measuring pressures. One inch of mercury column equals a pressure of 0.491 lb/in*.
Inches of Water Column:	A unit used in measuring pressures. One inch of water column equals a pressure of 0.578 oz/in^2. One inch mercury column equals about 13.6 in. water column.
Incomplete Combustion:	Combustion in which the fuel is only partially burned.
Indicating Device:	A device which indicates an alarm, supervisory or trouble condition. Frequently, audible and visual devices such as bells, horns, lamps, and flashing lights are used as indicating devices.
Indirect Water Heater:	A coil or bundle of tubes, usually copper, surrounded by hot boiler water. The domestic water is within the tube and is heated by transfer of heat from the hot boiler water surrounding the tube.
Indoor Design Temperature:	The indoor air temperature used when calculating the design heat loss. The indoor design temperature is usually assumed to be 70°F.
Indoor-Outdoor Temperature Difference:	The temperature of the indoor air minus the temperature of the outdoor air.
Induced Draft:	A process in which air is drawn through a heat exchanger, boiler, or cooling tower before entering the fan.
Induced Draft Burner:	A burner which depends on draft induced by a fan or blower at the flue outlet to draw in combustion air and vent flue gases.
Induced Draft Tower:	Type of mechanical draft tower in which the air moving device is located at the air exhaust.
Induction Air Terminal Units:	An assembly consisting of a cooling coil and/or heating coil that receives preconditioned air under pressure that is mixed with recirculated air by the induction process.
Induction Motor:	An AC motor which operates on principle of rotating magnetic field. Rotor has no electrical connection, but receives electrical energy by transformer action from field windings.

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Induction Units (Low-Pressure Type):	Essentially induction type convectors. They use a jet of conditioned air (or primary air) to induce into the unit a flow of room or secondary air which mixes with the primary air. The mixture is discharged into the room through a grille at the top of the unit. Heating coils are located in the secondary air stream for use in heating.
Industrial Air-Conditioning:	Air-conditioning for other uses than comfort.
Industrial Buildings:	Such buildings as small manufacturing plants, garage, and storehouses.
Inerts:	Non-combustible substances in a fuel, or in-flue gases such as nitrogen or carbon dioxide.
Infiltration:	Air leakage into a building from the out-of-doors as a result of wind and indoor-outdoor temperature difference.
Infrared Burner (Radiant Burner):	A burner which is designed to operate with a hot, glowing surface. A substantial amount of its energy output is in the form of infrared radiant energy.
Infrared Lamp:	An electrical device which emits infrared rays; invisible rays just beyond red in the visible spectrum.
Initiating Devices:	A device used to initiate the sequence of electrical events which results in a fire alarm or supervisory signal.
Injection:	Drawing primary air into a gas burner by means of a flow of fuel gas.
Input Rate:	The quantity of heat or fuel supplied to an appliance, expressed in volume or heat units per unit time, such as cubic feet per hour or BTU per hour.
Input Rating:	The gas-burning capacity of an appliance in BTU per hour as specified by the manufacturer. Appliance input ratings are based on sea level operation up to 2,000 feet elevation. For operation at elevations above 2,000 ft. input ratings should be reduced at the rate of 4 percent for each 1,000 ft above sea level.
Inspection:	Visual and mechanical checking of the condition of facilities, performed on a regularly scheduled basis, to determine the extent of the maintenance and repair work required and to ensure the proper operation of the systems.
Instantaneous Water Heater:	See tankless water heater.
Insulation, Thermal:	Substance used to retard or slow flow of heat through wall or partition.
Insulation:	Thermal insulation is a material used for covering pipes, ducts, vessels, etc. to effect a reduction of heat loss or gain.

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Interceptor:	A device designed and installed so as to separate and retain deleterious, hazardous, or undesirable matter from normal wastes while permitting normal sewage or liquid wastes to discharge into the drainage system by gravity.
Interlace:	Equipment which provides terminals for interconnecting two different systems, such as for interconnecting a building fire alarm system to the base alarm system.
Interference:	The thermal contamination of tower inlet air by air from a source extraneous to the tower.
Intermediate Chamber:	A portion of a differential dry pipe valve which is below the clapper (water side) and is at atmospheric air pressure when the dry pipe valve is "set" for operation.
Ion Exchange:	A chemical reaction used in water or waste water treatment processes in which mobile hydrated ions of a solid are exchanged (with ion of like charge in solution).
Ionize:	To convert totally or partially into ions (charged particles). This principle is used in some smoke detectors.
Isothermal:	Changes of volume or pressure under conditions of constant temperature.
Isothermal Expansion & Contraction:	An action which takes place without a temperature change.
Jet Burner:	A burner in which streams of gas or air-gas mixtures collide in air at some point above the burner and burn there.
Joint (Brazed, High-Temperature):	A gas tight joint obtained by the joining of metal parts with metallic mixtures or alloys which melt at temperatures below 1 800°F but above 1 000°F.
Joint (Soldered):	A gas-tight joint obtained by the joining of metal parts with metallic mixtures or alloys which melt at temperatures below 1 000°F.
Joint (Welded):	A gas tight joint obtained by the joining of metal parts in the plastic or molten state.
Joint, Expansion, Bellows:	An item of equipment used to compensate for the expansion and contraction of a run of pipe. The device is built with a flexible bellows that stretches or is compressed as necessary to accept the movement of the piping.
Joint, Expansion, Slip:	A joint in which the provision for expansion and contraction consists of a cylinder that moves in and out of the main body of the device.
Joints:	Joints include girth joints; branch and subbranch intersections; so-called duct collar tap-ins; fitting subsections; louver and air terminal connections to ducts; access door and access panel frames and jambs; duct, plenum, and casing abutments to building structures.

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Joule Thomson Effect:	Change in temperature of a gas on expansion through a porous plug from a high-pressure to a lower pressure.
Journal, Crankshaft:	Part of shaft which contacts the bearing.
Junction Box:	A box containing provisions for making electrical circuit connections.
Kelvin Scale **(K):**	Temperature scale in which the unit of measurement equals the centigrade degree and in which absolute zero is equivalent to -273.16°C. Water freezes at 273.16°K and boils at 373.16°K
Kilometer:	A metric unit of linear measurement 1000 meters.
Kilowatt:	Unit of electrical power, equal to 1000 watts.
Labeled:	Equipment or materials to which has been attached a label of a nationally recognized testing agency that maintains periodic inspection of production of labeled equipment or materials. Labeling indicates compliance with nationally recognized standards.
Lacquer:	A protective coating or finish which dries to form a film by evaporation of a volatile constituent.
Lapping:	Smoothing a metal surface to high degree of refinement or accuracy using a fine abrasive.
latent Heat:	Heat energy absorbed in process of changing form of substance (melting, vaporization, fusion without change in temperature or pressure).
Leachate:	A solution containing dissolved and finely suspended solid matter and microbial waste products produced by ground water or infiltrating surface water movement through solid waste.
Leader:	An exterior drainage pipe for conveying storm water from roof or gutter drains.
Leak Detector:	Device or instrument such as a halide torch, an electronic sniffer, or soap solution used to detect leaks.
Lean Mixture:	An air-gas mixture which contains more air than the amount needed for complete combustion of the gas.
Lifting Flames:	An unstable burner flame condition in which flames lift or blow off the burner port(s).
Limit Control:	Control used to open or close electrical circuits as temperature or pressure limits are reached.
Line Voltage:	The Voltage supplied by ordinary commercial sources, normally 115-l 25 Volts.

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Liquefied Natural Gas:	Natural gas which has been cooled until it becomes a liquid.
Liquefied Petroleum Gases:	The terms “Liquefied Petroleum Gases,” “LPG” and “LP Gas” mean and include any fuel gas which is composed predominantly of any of the following hydrocarbons, or mixtures of them: propane, propylene, normal butane or isobutane, and butylenes.
Liquid Absorbent:	A chemical in liquid form which has the property to “take on” or absorb moisture.
Liquid Indicator:	Device located in liquid line that provides a glass window through which liquid flow may be bserved.
Liquid Line:	The tube which carries liquid refrigerant from the condenser or liquid receiver to the refrigerant control mechanism.
Liquid Nitrogen:	Nitrogen in liquid form that is used as a low temperature refrigerant in chemical (or expendable) refrigerating systems.
Liquid Receiver:	Cylinder connected to condenser outlet for storage of liquid refrigerant in a system.
Liquid-Vapor Valve, Refrigerant Cylinder:	A dual hand valve on refrigerant cylinders which is used to release either gas or liquid refrigerant from the cylinder.
Liquor:	Solution used in absorption refrigeration.
Listed:	Equipment or materials included in a list published by a nationally recognized testing agency that maintains periodic inspection of production of listed equipment or materials. Listing indicates compliance with nationally recognized standards.
Listed by **UL:**	Equipment and devices which have been found by Underwriters Laboratories, Inc., through testing of samples to comply with the applicable standards.
Litharge:	Lead powder mixed with glycerin to seal pipe thread joints.
Lithium Bromide:	A chemical compound (salt) with the ability to absorb water and cool it by evaporation.
Load:	The amount of heat per unit time imposed on a refrigerating system. or the required rate of heat removal.
Lockout:	(See safety shutdown.)
Louvers:	Sloping, overlapping boards or metal plates intended to permit ventilation and shed falling water.
Low Fire Start:	The ignition of a burner with the fuel controls in a low fire position. In a system with guaranteed low fire start, interlocks are used to prevent startup if the burner is not in the low fire position.

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Low Link Control:	A switch operated by the temperature of the water in the boiler and used to start the burner at any time the water temperature drops to some prescribed minimum. This control is used if the boiler is supplying domestic hot water as well as heat for the building.
Low Pressure Compressed Air System:	Systems operating at pressure of 125 psig or less, and temperature 200°F or less.
Low Pressure Steam System:	One that operates at 15 psig (100 kPa above atmospheric) and under.
Low Side:	That portion of a refrigerating system that is under the lowest evaporating pressure.
Low Side Float Valve:	Refrigerant control valve operated by level of liquid refrigerant in low-pressure side of system.
Low Side Pressure:	Pressure in cooling side of refrigerating cycle.
Low Side Pressure Control:	Device used to keep low-side evaporating pressure from dropping below certain pressure.
Low Temperature Water System (LTW):	A hot water heating system operating at design water temperatures of 250°F or less and a maximum working pressure of 160 psi.
Low Voltage Control:	Controls designed to operate at Voltages of 20 to 30 V.
Low Water Fuel Cutoff:	A device that shuts off the fuel when the boiler water falls to an unsafe level.
LP Gas-Air Mixtures:	Liquefied petroleum gases distributed at relatively low-pressures and normal atmospheric temperatures which have been diluted with air to produce desired heating value and utilization characteristics.
Main:	Duct or pipe containing the system's major or entire fluid flow.
Main Burner Flame Establishing Period:	The interval of time the main burner fuel safety shutoff valves are permitted to be open before the primary safety control is required to prove the presence of the main burner flame.
Maintenance:	Day-to-day, periodic, or scheduled work required to preserve or restore a facility or equipment to a condition that it can be effectively utilized for its designed purpose.
Make Up Water Line:	The water connection to the boiler or system for filling or adding water when necessary.
Make-up Air:	The air which is supplied to a building to replace air that has been removed by an exhaust system.
Makeup:	Water added to the system to replace water lost by evaporation, drift, blowdown, and leakage.

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Manifold:	The conduit of an appliance which supplies gas to the individual burners.
Manifold, Service:	A device equipped with gauges and manual valves, used by serviceman to service refrigerating systems.
Manifold Pressure:	The gas pressure in an appliance manifold, upstream of burner orifices.
Manometer:	Instrument for measuring pressure of gases and vapors. Gas pressure is balanced against column of liquid such as mercury, in U-shaped tube.
Manual Reset Device:	A component of a control that requires resetting by hand to restart the burner after safe operating conditions have been restored.
Manufactured Gas:	A fuel gas which is artificially produced by some process, as opposed to natural gas, which is found in the earth. Sometimes called town gas.
Mass:	A quantity of matter cohering together to make one body which is usually of indefinite shape.
Master Box:	A municipal fire alarm box which may be tripped manually at the box or remotely by electronic means.
Matrix:	A rectangular array of indicators, usually lamps or LED's, for identification of zone status in larger alarm systems.
Mean Effective pressure (MEP):	Average pressure on a surface when a changing pressure condition exists.
Mechanical Cycle:	Cycle which is a repetitive series of mechanical events.
Mechanical Draft:	The movement of air through a heat exchanger, boiler, or cooling tower by means of a fan or other mechanical device.
Mechanical Draft lower:	Type of cooling tower through which the air movement is affected by mechanical devices. See forced draft tower and induced draft tower.
Medium, Heating:	A substance used to convey heat from the heat source to the point of use. It is usually air, water, or steam.
Medium-pressure Compressed Air System:	Systems operating at pressure between 125 psig and 200 psig, or operating at temperatures of more than 200°F.
Medium-Temperature Water System:	A hot water system operating at temperatures of 350°F or less, with pressures not exceeding 150 psi.
Melting Point:	Temperature at atmospheric pressure, at which a substance will melt.
Mercoid Bulb:	An electrical circuit switch which uses a small quantity of mercury in a sealed glass tube to make or break electrical contact with terminals within the tube.
Meter:	Metric unit of linear measurement equal to 39.37 in.

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Methane:	A hydrocarbon gas with the formula CH4, the principal component of natural gases.
Methanol Dryer:	Alcohol type chemical used to change water in refrigerating system into a nonfreezing solution.
Methyl Chloride (R40):	A chemical once commonly used as a refrigerant. The chemical formula is CH3Cl. Cylinder color code is orange. The boiling point at atmospheric pressure is -10.4°F.
Metric System:	A decimal system of measures and weights, based on the meter and gram. Length of one meter, 39.37 in.
Micrometer:	A precision measuring instrument used for making measurements accurate to .001 to .0001 in.
Micron:	Unit of length in metric system a thousandth part of one millimeter.
Micron Gauge:	Instrument for measuring vacuums very close to a perfect vacuum.
Mixed Gas:	A gas in which the heating value of manufactured gas is raised by co-mingling with natural or LPG (except where natural gas or LPG is used only for "enriching" or "reforming").
Mixer:	That portion of a burner where air and gas are mixed before delivery to the burner ports.
Mixer Face:	The air inlet end of the mixer head.
Mixer Head:	That portion of an injection type burner, usually enlarged, into which primary air flows to mix with the gas stream.
Mixer Throat (Venturi Throat):	That portion of the mixer which has the smallest cross-sectional area, and which lies between the mixer head and the mixer tube.
Mixer lube:	That portion of the mixer which lies between the throat and the burner head.
Mixing Box:	A chamber, usually located in an air handler upstream of the filters, that collects outside air and return air. Mixing is generally controlled with dampers.
Modulating:	A type of device or control which tends to adjust by increments (minute changes) rather than by either full on or full off operation.
Modulating Refrigeration Cycle:	Refrigerating system of variable capacity.
Module:	A self contained assembly of components and circuitry that performs certain functions in an alarm system.
Moisture Determination:	An action using instruments and calculations to measure the relative or absolute moisture in an air conditioned space.
Moisture Indicator:	Instrument used to measure moisture content of a refrigerant.

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Molecule:	Smallest portion of an element or compound that retains chemical identity with the substance in mass.
Molliers Diagram:	Graph of refrigerant pressure, heat, and temperature properties.
Monel:	A trademark name for metal alloy consisting chiefly of copper and nickel.
Monothlorodifluoromethane:	A refrigerant better known as Freon 12 or R-22. Chemical formula is CHCIF. Cylinder color code is green.
Motor, Capacitor:	A single-phase induction motor with an auxiliary starting winding connected in series with a condenser (capacitor) for better starting characteristics.
Motor **- 2-Pole:**	A 3600 rpm electric motor (synchronous speed).
Motor **- 4-Pole:**	A 1800 rpm electric motor (synchronous speed).
Motor Burnout:	Condition in which the insulation of electric motor has deteriorated by overheating.
Motor Control:	Device to start and/or stop a motor at certain temperature or pressure conditions.
Motor Starter:	High capacity electric switches usually operated by electromagnets.
Muffler, Compressor:	Sound absorber chamber in refrigeration system used to reduce sound of gas pulsations.
Multiple Evaporator System:	Refrigerating system with two or more evaporators connected in parallel.
Multiple System:	Refrigerating mechanism in which several evaporators are connected to one condensing unit.
Multiple Zone:	A system controlled by two or more thermostats.
Natural Convection:	Movement of a fluid caused by temperature differences (density changes).
Natural Draft:	Refers to the movement of air through a heat exchanger, cooling tower, boiler, furnace, etc. by the force of the air density differential (produced by the addition of heat).
Natural Draft lower:	Type of cooling tower through which the air movement is affected by the difference in densities of the entering and exhaust air.
Natural Gas:	Any gas found in the earth, as opposed to gases which are manufactured.
Neoprene:	A synthetic rubber which is resistant to hydrocarbon oil and gas.
Net Bating:	A rating applied to boilers. It is the quantity of heat available in BTU/hr for the connected load.
Neutralizer:	Substance used to counteract acids in refrigeration system.

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Nominal Size Tubing:	Tubing measurement which has an inside diameter the same as iron pipe of the same stated size.
Non-Code Installation:	A functional refrigerating system installed where there are no local, state, or national refrigeration codes in force.
Non-Condensible Gas:	Gas which does not change into a liquid at operating temperatures and pressures.
Non-Ferrous:	Group of metals and metal alloys which contain no iron.
Non-Frosting Evaporator:	An evaporator which never collects frost or ice on its surface.
Non-Potable Water:	Water not safe for drinking or for personal or culinary use.
Normal Charge:	The thermal element charge which is part liquid and part gas under all operating conditions.
Odorant:	A substance added to an otherwise odorless, colorless, and tasteless gas to give warning of gas leakage and to aid in leak detection.
Off Cycle:	That part of a refrigeration cycle when the system is not operating.
Ohmmeter:	An instrument for measuring resistance to the flow of electrical current.
Oil, Refrigeration:	Specially prepared oil used in refrigerator mechanism circulates to same extent with refrigerant. The oil must be dry (entirely free of moisture), otherwise, moisture will condense out and freeze in the refrigerant control and may cause refrigerant mechanism to fail. An oil classified as a refrigerant oil must he free of moisture and other contaminants.
Oil Binding:	Physical condition when an oil layer on top of refrigerant liquid hinders it from evaporating at its normal pressure-temperature condition.
Oil Burner Relay:	A special, multi-purpose control used with oil burners. The device controls the operation of the oil burner and also acts as a safety to prevent operation in the event of malfunction.
Oil Rings:	Expanding rings mounted in grooves and piston designed to prevent oil from moving into compression chamber.
Oil Separator:	Device used to remove oil from gaseous refrigerant.
One-Pipe Fitting:	A specially designed tee for use in a one-pipe system to connect the supply or return branch into a circuit. These fittings cause a portion of the water flowing through the circuit to pass through the terminal unit.
One-Pipe System:	A forced hot-water system using one continuous pipe or main from the boiler supply to the boiler return. The terminal units are connected to this pipe by two smaller pipes known as supply and return branches.

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Open Circuit:	A circuit that has been broken by opening a switch or breaking a wire. An interrupted electrical circuit which stops flow of electricity.
Open Display Case:	Commercial refrigerator designed to maintain its contents at refrigerating temperatures even though the contents are in an open case.
Open Type System:	A refrigerating system which uses a belt-driven compressor or a coupling-driven compressor.
Orifice:	An opening in an orifice cap (hood), orifice spud, or other device through which gas is discharged, and whereby the flow of gas is limited and/or controlled. (See also Universal Orifice.)
Orifice Cap (Hood):	A movable fitting having an orifice which permits adjustment of the flow of gas by changing its position with respect to a fixed needle or other device extending into the orifice.
Orifice Discharge Coefficient:	(See Discharge Coefficient.)
Oscilloscope:	A fluorescent coated tube which visually shows an electrical wave.
Outdoor Design Temperature:	The outdoor temperature on which design heat losses are based.
Outside Air:	External air - atmosphere exterior to refrigerated or conditioned space - ambient (surrounding) air.
Overload:	Load greater than load for which system or mechanism was intended.
Overload Protector:	A device, either temperature, pressure, or current operated, that will stop operation of unit if dangerous conditions arise.
Overrating:	Operation of a gas burner at a greater rate than it was designed for.
Oxidation:	The combining of oxygen with another element to form a new substance, such as in burning and rust formation.
Oxygen:	An elemental gas that comprises approximately 21 percent of the atmosphere by volume. Oxygen is one of the elements required for combustion.
Ozone:	A gaseous form of oxygen usually obtained by silent discharge of electricity in oxygen or air.
Packaged Boiler:	A boiler having all components (including burner, boiler, controls, and auxiliary equipment) assembled as a unit.
Panel Heating:	A heating system in which heat is transmitted by both radiation and convection from panel surfaces to both air and surrounding surfaces.
Panel Radiator:	A heating unit placed on or flush with a flat wall surface, and intended to function essentially as a radiator.

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Panel Systems:	Or radiant system. A heating system in which the ceiling or floor serves as the terminal unit.
Partial Pressures:	Condition where two or more gases occupy a space and each one creates part of the total pressure.
Partition Wall:	Vertical interior wall, either transverse, longitudinal, or radial, that subdivides a mechanical or natural draft tower into cells.
Pascal's Law:	A pressure imposed upon a fluid is transmitted equally in all directions.
Peak Load:	The maximum load carried by a system or a unit of equipment over a designated period of time.
Penn:	The unit of permeance. A perm is 'equal to 1 grain per sq. ft./hr., inch of mercury vapor pressure difference.
Permanent Magnet:	A material which has its molecules aligned and has its own magnetic field. A bar of metal which has been permanently magnetized.
Penneance:	The water vapor permeance of a sheet of any thickness (or assembly between parallel surfaces) is the ratio of water vapor flow to the vapor pressure difference between the surfaces. Permeance is measured in perms.
pH or pH Value:	A term based on the hydrogen ion concentration in water, which denotes whether the water is acid, alkaline, or neutral. A pH value of 8 or more indicates a condition of alkalinity; of 6 or less, acidity. A pH of 7 means the water is neutral.
Photoelectricity:	A physical action wherein an electrical flow is generated by light waves.
Pilot:	A small flame which is used to ignite the gas at the main burner.
Pilot, Continuous (also known as constant burning pilot):	A pilot that burns without turndown throughout the entire time the burner assembly is in service, whether the main burner is firing or not.
Pilot, Intermittent:	A pilot that is automatically lighted each time there is a call for heat. It burns during the entire period the main burner is firing.
Pilot, Interrupted:	A pilot that is automatically lighted each time there is a call for heat. The pilot fuel is cut off automatically at the end of the main burner flame-establishing period.
pilot, Proved:	A pilot flame supervised by a primary safety control.
Pilot Flame-Establishing Period:	The interval of time that fuel is permitted to be delivered to a pilot burner before the primary safety control is required to prove the pilot flame.
Pilot Switch:	A control used in conjunction with gas burners. Its function is to prevent operation of the burner in the event of pilot failure.

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Pinion:	A small cogwheel or gear which engages by a larger gear or a rack.
piston:	Close fitting part which moves up and down in a cylinder.
Piston Displacement:	Volume displaced by piston as it travels length of stroke.
Pitch:	The amount of slope given to a horizontal pipe when it is installed in a heating system.
Pitot lube:	An instrument for measuring velocity pressure in flowing air or water.
Playpipe:	A nozzle which is used primarily for fire pump testing.
Plenum Chamber:	An air compartment maintained. under pressure, and connected to one or more distributing ducts.
Plumbing Fixture:	A receptor or device which is either permanently or temporarily connected to the water distribution system of the premises, and demands a supply of water therefrom, or discharges used water, liquid-borne waste materials, or sewage directly or indirectly to the drainage system of the premises, or which requires both a water supply connection and a discharge to the drainage system of the premises.
Pneumatic:	Pertaining to air or other gases.
Point of Delivery:	The outlet of the service meter assembly, or the outlet of the service regulator (service shutoff valve when no meter is provided).
Polarity:	The possession of two opposing qualities.
Pollution:	The addition of sewage, industrial wastes, or other harmful or objectionable material to water. Sources of pollution may be privies, septic tanks, subsurface irrigation fields, seepage pits, sink drains, barnyard wastes, etc.
Polyphase Motor:	Electrical motor designed to be used with three-phase electrical circuit.
Poppet:	A piston like device which acts as a valve to stop water flow.
port:	Any opening in a burner head through which gas or an air-gas mixture is discharged for ignition.
Port Loading:	The input rate of a gas burner per unit of port area, obtained by dividing input rate by total port area. Usually expressed in terms of BTU per hour per square inch of port area.
Post purge period:	A period of time after the fuel valves close, during which the burner motor or fan continues to run to supply air to the combustion chamber.

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Potable Water:	Water free from impurities present in amounts sufficient to cause disease or harmful physiological effects and conforming in its bacteriological and chemical quality to the requirements of the Public Health Service Drinking Water Standards or the regulations of the public health authority having jurisdiction.
Potable:	Acceptable for human consumption.
Pour Point (oil):	Lowest temperature at which oil will pour or flow.
Power:	Time rate at which work is done or energy emitted. Source or means of supplying energy.
Power Burner:	(See Burner.)
Power Disconnect:	A switch for connecting and disconnecting electrical power.
Power Element:	Sensitive element of a temperature operated control.
Pre-Action System:	A sprinkler in which the water control valve is operated independently from the sprinkler.
Pre-Mixing Burner:	A burner in which all, or nearly all, combustion air is mixed with the gas as primary air.
Pre-Purge Period:	A period of time on each startup during which air is introduced into the combustion chamber and associated flue passages in volume and manner as to completely replace the air or fuel-air mixture contained therein prior to initiating ignition.
Pressure:	An energy impact on a unit area, force, or thrust exerted on a surface.
Pressure Burner:	A burner in which an air and gas mixture under pressure is supplied, usually at 0.5 to 14 in. water column.
pressure Drop:	The pressure difference at two ends of a circuit or part of a circuit, the two sides of a filter or the pressure difference between the high-side and low-side in a refrigeration mechanism.
Pressure Head:	The force available to cause circulation of water or vapor in a hydronic system. See head, pump head, available head.
Pressure Limiter:	Device which remains closed until a certain pressure is reached and then opens and releases fluid to another part of system.
Pressure Maintenance pump:	Pump intended to maintain water pressure in system.
Pressure Maintenance Pump Unit:	Assembled unit consisting of pressure maintenance pump, driver, controller, and accessories.
Pressure Motor Control:	A device which opens and closes an electric circuit as pressures change to desired pressures.

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Pressure Operated Altitude (POA) Valve:	Device which maintains a constant low-side pressure independent of altitude of operation.
Pressure Reducing Valve:	A diaphragm operated valve installed in the make-up water line of a hot water heating system to introduce water into the system and to prevent the system from possible exposure to city water pressures higher than the working pressure of the boiler.
Pressure Regulator:	A device for controlling and maintaining a uniform outlet gas pressure.
Pressure Regulator Evaporator:	An automatic pressure regulating valve mounted in suction line between evaporator outlet and compressor inlet. Its purpose is to maintain a predetermined pressure and temperature in the evaporator.
Pressure Relief Valve:	A device for protecting a hot water boiler (or a hot water storage tank) from excessive pressure by opening at a predetermined pressure and discharging water or steam at a rate sufficient to prevent further build-up of pressure.
Pressure Suction:	Pressure in low-pressure side of a refrigerant system.
pressure Water Valve:	Device used to control water flow which is responsive to head-pressure of refrigerating system.
Pressure-Heat Diagram:	Graph of refrigerant pressure heat and temperature properties. (Mollier's diagram.)
Primary Air:	The combustion air introduced into a burner which mixes with the gas before it reaches the port. Usually expressed as a percentage of air required for complete combustion of the gas.
Primary Air Inlet:	The opening(s) through which primary air is admitted into a burner.
Primary Control:	Device which directly controls operation of heating system.
Priming Water:	A small amount of water added to a dry pipe valve to provide a tight seal.
Procedure:	Standardized approach and execution of sequence of work operations to yield reproducible results.
Process Tube:	Length of tubing fastened to hermetic unit dome used for servicing unit,
Propane:	A hydrocarbon gas heavier than methane but lighter than butane. It is used as a fuel gas alone, mixed with air, or as a major constituent of liquefied petroleum gases.
proportioning:	The action by which foam liquid and water are mixed to form a foam solution.
Protector, Circuit:	An electrical device which will open an electrical circuit if excessive electrical conditions occur.

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Proven Prepurge:	A provision of the control system for preventing burner operation until prescribed air flow is proven to be established during prepurge.
Psychometric Measurement:	Measurement of temperature pressure and humidity using a psychometric chart.
Psychrometer or Wet Bulb Hygrometer:	An instrument for measuring the relative humidity of atmospheric air.
Psychrometric Chart:	A chart that shows relationship between the temperature pressure and moisture content of the air.
Pull Down:	An expression indicating action of removing refrigerant from all or a part of refrigerating system.
Pulsation:	A panting of the flames in a boiler or furnace, indicating cyclic and rapid changes in the pressure in the combustion space.
Pump:	A motor driven device used to mechanically circulate water in the system. Also called a circulator.
Pump Down:	The act of using a compressor or a pump to reduce the pressure in a container or a system.
Pump Head:	The pressure differential produce by an operating pump.
Purge Pump:	A compressor that removes non-condensibles from a refrigeration system.
Purging:	Releasing compressed gas to atmosphere through some part or parts for the purpose of removing contaminants from that part or parts.
pyrometer:	Instrument for measuring high temperatures.
Quenching:	A reduction in temperature whereby a combustion process is retarded or stopped. Submerging hot solid object in cooling fluid.
R-11 Trichloromonofluoromethane:	Low-pressure, synthetic chemical refrigerant which is also used as a cleaning fluid.
R-12 Dichlorodifluoromethane:	A popular refrigerant known as Freon 12.
R-22 Monochlorodifluoromethane:	Synthetic chemical refrigerant.
R40 Methyl Chloride:	Refrigerant which was used extensively in the 1920's and 1930's.
R-l 13, Trichlorotrifluoroethane:	Synthetic chemical refrigerant.
R-160, Ethyl Chloride:	Refrigerant which is seldom used at present time.
R-l 70, Ethane:	Low-temperature application refrigerant.
R-290, Propane:	Low-temperature application refrigerant.

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R-500:	Refrigerant which is azeotropic mixture of R-12 and R-l 52a.
R-502:	Refrigerant which is azeotropic mixture of R-22 and R-l 15.
R-503:	Refrigerant which is azeotropic mixture of R-23 and R-13.
R-504:	Refrigerant which is azeotropic mixture of R-32 and R-l 15.
R-600, Butane:	Low-temperature application refrigerant; also used as a fuel.
R-611, Methyl Fonnate:	Low-pressure refrigerant.
R-71 7, Ammonia:	Popular refrigerant for industrial refrigerating systems; also a popular absorption system refrigerant.
R-764, Sulphur Dioxide:	Low pressure refrigerant used extensively in 1920's and 1930's. Not in use at present; chemical is often used as an industrial bleaching agent.
Radiant Burner:	(See Infrared Burner.)
Radiant Heating:	A heating system in which only the heat radiated from panels is effective in providing the heating requirements. The term radiant heating is frequently used to include both panel and radiant heating.
Radiant Heating Systems:	Systems with heating terminals that deliver heat by radiation from a hot surface.
Radiation:	The transmission of energy by means of electromagnetic waves.
Radiator:	A heating unit exposed to view within the room or space to be heated. A radiator transfers heat by radiation to objects within visible range, and by conduction to the surrounding air which in turn is circulated by natural convection; a so-called radiator is also a convector, but the term radiator has been established by long usage.
Radiator (Concealed):	A heating device located within, adjacent to, or exterior to the room being heated; but so covered, enclosed, or concealed that the heat transfer surface of the device, which may be either a radiator or a convector, is not visible from the room. Such a device transfers its heat to the room largely by convection air currents.
Radiator Valve:	A valve installed on a terminal unit to manually control the flow of water through the unit.
Range:	Pressure or temperature settings of a control; change within limits.
Rankine Scale:	Name given the absolute (Fahrenheit) scale. Zero on this scale is -460°F.
Rate:	(See Input.)
Readily Accessible:	Direct access without requiring the use of tools from removing or moving any panel, door, or similar obstruction.

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Receiver Heating Element:	Electrical resistance mounted in or around liquid receiver, used to maintain head pressures when ambient temperature is at freezing or below freezing.
Receiver-Dryer:	A cylinder in a refrigerating system for storing liquid refrigerant and that also holds a quantity of desiccant.
Receptor:	A fixture or device that receives the discharge from indirect waste pipes.
Reciprocating:	Action in which the motion is back and forth in a straight line.
Reciprocating Compressor or Chiller:	Single acting compressor using pistons that are driven by a connecting rod from a crankshaft.
Recirculated Air:	Return air passed through the conditioner before being again supplied to the conditioned space.
Recirculation:	That portion of tower exhaust air which reenters the tower inlet. It can be expressed as a difference between the average entering and windward side wet-bulb temperatures.
Recording Ammeter:	Electrical instrument that uses a pen to record amount of current flow on a moving paper chart.
Recording Thermometer:	Temperature measuring instrument that has a pen marking a moving chart.
Rectifier, Electric:	An electrical device for converting AC into DC.
Recycle:	The process of sequencing a normal burner start following shutdown.
Reducing Fitting:	A pipe fitting designed to change from one pipe size to another.
Redundant:	Duplicate or extra.
Reed Valve:	Thin, flat, tempered, steel plate fastened at one end.
Refrigerant:	Substance used in refrigerating mechanism to absorb heat in evaporator coil by change of state from a liquid to a gas, and to release its heat in a condenser as the substance returns from the gaseous state back to a liquid state.
Refrigerant Charge:	The quantity of refrigerant in a refrigerant system.
Refrigerant Control:	Device which meters refrigerant and maintains pressure difference between high-pressure and low-pressure side of mechanical refrigerating system while unit is running.
Register:	Combination grille and damper assembly covering on an air opening or end of an air duct.
Regulated:	Processed for constant and precise output.
Regulator:	(See Pressure Regulator.)
Relative Humidity:	Ratio of amount of water vapor present in air to greatest amount possible at same temperature.

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Relay:	An electrically operated switch. Usually the control circuit of the switch uses low Voltage while the switch makes and breaks a line Voltage circuit. However, both the control and load circuits are of the same Voltage in some instances.
Relief Opening:	The opening in a draft hood to permit ready escape to the atmosphere of flue products from the draft hood in event of no draft, back draft, or stoppage beyond the draft hood, and to permit inspiration of air into the draft hood in the event of a strong chimney updraft.
Relief Valve:	Safety device designed to open before dangerous pressure is reached.
Remote Power Element Control:	Device with sensing element located apart from operating mechanism.
Remote System:	Refrigerating system which has condensing unit located outside and separate from refrigerator cabinet.
Repair:	Restoration of a facility or equipment to a condition to allow it to be used for its intended purpose.
Repulsion-Start Induction Motor:	Type of motor which has an electrical winding on the rotor for starting purposes.
Residential Buildings:	Single family homes, duplexes, apartment buildings.
Response Time:	This term when used to specify performance of a rapid-action, deluge fire protection system represents the elapsed time between the initiation of the incident and water application to the material being protected.
Retard Chamber:	A mechanical device which acts as a time delay in sounding an alarm upon flow of water in sprinkler system.
Retard:	An assembly to delay the switch action of a water flow detector to avoid false alarms.
Return Branch:	The piping used to return water from a terminal unit to the main, circuit main, or trunk.
Return Mains:	Pipes or conduits which return the heating or cooling medium from the heat transfer unit to the source of heat or refrigeration.
Return Piping:	That portion of the piping system that carries water from the terminal units back to the boiler.
Return lapping:	The opening in a boiler into which the pipe used for returning condensate or water to the boiler is connected.
Reverse Acting Control:	A switch controlled by temperature and designed to open on temperature drop and close on temperature rise.
Reverse Cycle Defrost:	Method of heating evaporator for defrosting purposes by using valves to move hot gas from compressor into evaporator.

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Reverse Return:	A two-pipe system in which the return connections from the terminal units into the return main are made in the reverse order from that in which the supply connections are made in the supply main.
Reversing Valve:	Device used to reverse direction of the refrigerant flow depending upon whether heating or cooling is desired.
Rich Mixture:	A mixture of gas and air containing too much fuel or too little air for complete combustion of the gas.
Ringelmann Scale:	Measuring device for determining smoke density.
Riser:	This generally refers to the vertical portion of the supply or return branches. However, any vertical piping in the heating system might be termed a riser.
Riser Valve:	Device used to manually control flow of refrigerant in vertical piping.
Rotary Blade Compressor:	Mechanism for pumping fluid by revolving blades inside cylindrical housing.
Rotary Compressor:	Mechanism which pumps fluid by using rotating motion.
Rotor:	Rotating part of a mechanism.
Run-Out:	This term generally applies to the horizontal portion of branch circuits or the measurement of play in a bearing/shaft.
Running Winding:	Electrical winding of motor which has current flowing through it during normal operation of motor.
Safety (also known as limit):	A control responding to changes in liquid level, pressure, or temperature.
Safety Control:	Device which will stop the refrigerating unit if unsafe pressures and/or temperatures are reached.
Safety Motor Control:	Electrical device used to open circuit if the temperature, pressure, and/or the current flow exceed safe conditions.
Safety Plug:	Device which will release the contents of a container above normal pressure conditions and before rupture pressures are reached.
Safety Shutdown (also known as lockout):	Shutting off all fuel and ignition energy to the burner by means of a safety control or controls so that restart cannot be accomplished without manual reset.
Safety Valve:	A device for protecting a steam boiler from excessive pressure by opening at a predetermined pressure setting and allowing steam to escape at a rate equal to or greater than the steam generating capacity of the boiler.
Sanitary Building Drain:	A building drain which conveys sewage only.
Sanitary Drainage System:	A drainage system which carries sewage and excludes storm, surface, and ground water.

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Sanitary Sewer:	A building sewer which conveys sewage only.
Saturation:	Condition existing when substance contains maximum of another substance for that temperature and pressure.
Scavenger Pump:	Mechanism used to remove fluid from sump or container.
Schrader Valve:	Spring loaded device which permits fluid flow in one direction when a center pin is depressed; in other direction when a pressure difference exists.
Seal, Shaft:	A device used to prevent leakage between shaft and housing.
Seal Leak:	Escape of oil and/or refrigerant at the junction where shaft enters housing.
Sealed Unit:	(See Hermetic System.) A motor-compressor assembly in which motor and compressor operate inside sealed dome or housing.
Seam:	A seam is defined as joining of two longitudinally (in the direction of airflow) oriented edges of duct surface material occurring between two joints. All other duct surface connections made on the perimeter are deemed to be joints.
Second Law of Thermodynamics:	Heat will flow only from material at certain temperature to material at lower temperature.
Secondary Air:	Combustion air externally supplied to a burner flame at the point of combustion.
Secondary Refrigerating System:	Refrigerating system in which condenser is cooled by evaporator of another or primary refrigerating system.
Sensible Heat:	Heat which causes a change in temperature of a substance.
Sensor:	A material or device which goes through a physical change or an electronic characteristic change as the conditions change.
Separator, Oil:	A device used to separate refrigerant oil from refrigerant gas and return the oil to crankcase of compressor.
Septic Tank:	A water tight receptor which receives the discharge of a building sanitary drainage system or part thereof, and is designed and constructed so as to separate solids from liquids, digest organic matter through a period of detention, and allows liquids to discharge into the soil outside of the tank through a system of open joint or perforated piping, or a seepage pit.
Sequence Controls:	Group of devices that act in series or in time order.
Series Loop:	A forced hot water heating system with the terminal units connected so that all the water flowing through the circuit passes through each series-connected unit in the circuit.

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Service Pipe:	A pie connecting water or gas mains into a building from the street.
Service Valve:	A device to be attached to system which provides opening for gauges and/or charging lines. Also provides means of shutting off or opening gauge and charging ports, and controlling refrigerant flow in system.
Serviceable Hermetic:	Hermetic unit housing containing motor and compressor assembled by use of bolts or threads.
Sewage Ejector (Pneumatic):	A device for lifting sewage by air pressure.
Sewage Pump:	A permanently installed mechanical device other than an ejector for removing sewage or liquid waste from a sump.
Sewage:	Any liquid waste containing animal and vegetable matter in suspension or solution, and may include liquids containing chemicals in solution.
Shaded Pole Motor:	A small AC motor used for light start loads. Has no brushes or commutator.
Shall:	Denotes a requirement.
Shell Type Condenser:	Cylinder or receiver which contains condensing water coils or tubes.
Shell=& lube Flooded Evaporator:	Device which flows water through tubes built into cylindrical evaporator or vice-versa.
Short Cycling:	Refrigerating system that starts and stops more frequently than it should.
Should:	Denotes a recommendation.
Shroud:	Housing over condenser or evaporator.
Shunt Trip:	Term used to describe the method of tripping transmitting device in which elements of a building alarm system are connected in parallel (shunt) with the transmitter trip coil.
Siamese Connection:	See Fire Department Connection.
Sight Glass:	Glass tube or glass window in refrigerating mechanism which shows amount of refrigerant or oil in system, or pressure of gas bubbles in liquid line.
Sight Glass:	A glass tube sealed within a fluid system, providing a means to examine (visually) the fluid in the system.
Silica Gel:	Chemical compound used as a dryer, that has the ability to absorb moisture when heated. Moisture is released and compound may be reused.
Silver Brazing:	Brazing process in which brazing alloy contains some silver as part of joining alloy.
Single Circuit System:	A hydronic system composed of only one circuit.

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Single Port Burner:	A burner in which the entire air-gas mixture issues from a single port.
Sintered Oil Bearing:	Porous bearing metal, usually bronze, and which has oil in pores of bearing metal.
Sling Psychrometer:	Humidity measuring device with wet and dry bulb thermometers, which is moved rapidly through air when measuring humidity.
Smoke:	An air suspension (aerosol) of particles, usually but not necessarily solid, often originating in a solid nucleus, formed from combustion or sublimation. Also defined as carbon or soot particles less than 0.1 micron in size that result from the incomplete combustion of carbonaceous materials such as coal, oil, tar, and tobacco.
Sott Flame:	A flame partially deprived of primary air such that the combustion zone is extended and inner cone is ill-defined.
Solar Heat:	Heat from visible and invisible energy waves from the sun.
Soldering:	Joining two metals by adhesion of a low melting temperature metal (less than 800°F).
Solenoid Valve:	Electromagnet with a moving core that serves as a valve or operates a valve.
Solid Absorbent Refrigeration:	Refrigerating system which uses solid substance as absorber of the refrigerant during cooling part of cycle and releases refrigerant when heated during generating part of cycle.
Solid State:	Related to the technology of semiconductors that led to the development of transistors, diodes, light emitting diodes (LED's), and other devices.
Soot:	A black substance, mostly consisting of small particles of carbon, that can result from incomplete combustion and appear as smoke.
Sound Level:	A weighted sound pressure level obtained by the use of metering characteristics and the weighting A, B, or C specified in the American National Standard Specification for Sound Level meters, ANSI 51.4.
Sound pressure Level:	The sound pressure level, in decibels (dB), of a sound is 20 times the logarithm to the base 10 of the ratio of the pressure of this sound to the reference pressure or 0.0002 microbars. It is the generally accepted unit of sound pressure level.
Specific Gravity:	Specific gravity is the ratio of the weight of a given volume of gas to that of the same volume of air, both measured at the same temperature and pressure.
Specific Heat:	Ratio of quantity of heat required to raise temperature of a body one degree to that required to raise temperature of equal mass of water one degree.

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Specific Volume:	The volume of air-vapor mixture per unit mass of dry air.
Splash System, Oiling:	Method of lubricating moving parts by agitating or splashing oil.
Split System:	Refrigeration or air-conditioning installation which places condensing unit outside or remote from evaporator. Also applicable to heat pump installations.
Split-Phase Motor:	Motor with two stator windings. Winding in use while starting is disconnected by centrifugal switch after motor attains speed, then motor operates on other winding.
Splitter Damper:	A single blade damper hinged at one end, installed to divert air from a main duct into a branch duct.
Spoiler Screw (Breaker Bolt):	A screw or bolt moved in or out of the gas jet in a burner to control primary air injection.
Spray Cooling:	Method of refrigerating by spraying refrigerant inside of evaporator or by spraying refrigerated water.
Sprinkler:	A device to distribute water on a fire.
Sprinkler Riser:	A portion of a sprinkler system which contains the system control valve.
Square Foot (Steam):	A term used to express the output of boilers and radiation. When applied to boilers, it is 240 BTU/hr; when applied to terminal units, it represents the amount of radiation which will emit 240 BTU/hr when supplied with steam at 215°F and air at 65°F.
Square Head Cock:	A type of valve often used as a balancing valve. In place of the valve handle, the stem is made square. A wrench is used to adjust the valve setting.
Squirrel Cage:	Fan which has blades parallel to fan axis and moves air at right angles or perpendicular to fan axis.
Standard Atmosphere:	Condition when air is at 14.7 psia pressure, at 68°F temperature.
Standard Conditions:	Used as a basis for air-conditioning calculations. Temperature of 68°F, pressure of 29.92 inches of Hg and relative humidity of 30 percent.
Standby Battery:	A battery used as a secondary power supply for operation of a set of fire alarm equipment.
Starting Relay:	An electrical device which connects and/or disconnects starting winding of electric motor.
Starting Winding:	Winding in electric motor used only during brief period when motor is starting.
Stationary Blade Compressor:	A rotary pump which uses blade inside pump to separate intake chamber from exhaust chamber.
Stator, Motor:	Stationary part of electric motor.

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Steam:	Water in vapor state.
Steam Heating System:	A hydronic system in which steam is circulated through the terminal units.
Steam Jet Refrigeration:	Refrigerating system which uses a steam venturi to create high vacuum (low-pressure) on a water container causing water to evaporate at low temperature.
Steam-Heating:	Heating system in which steam from a boiler is conducted to radiators in space to be heated.
Stepped Down:	Refers to AC Voltage reduced by the use of a step-down transformer to a lower AC Voltage.
Stethoscope:	Instrument used to detect sounds.
Stoker:	Machine used to supply a furnace with coal.
Storm Drainage System:	A drainage system which carries rain water, surface water, condensate, cooling water, or similar liquid wastes.
Strainer:	Device such as a screen or filter used to retain solid particles while liquid passes through.
Stratification of Air:	Condition in which there is little or no air movement in room; air lies in temperature layers.
Subcooling:	Cooling of liquid refrigerant below its condensing temperature.
Sublimation:	Condition where a substance changes from a solid to a gas without becoming a liquid.
Submain:	Duct or pipe containing part of the systems' capacity and serving two or more branch mains.
Suction Line:	Tube or pipe used to carry refrigerant gas from evaporator to compressor.
Suction Pressure Control Valve:	Device located in the suction line which maintains constant pressure in evaporator during running portion of cycle.
Suction Service Valve:	A two-way, manually-operated valve located at the inlet to compressor, which controls suction gas flow and is used to service unit.
Sulfur Dioxide:	Gas once commonly used as a refrigerant. Refrigerant number is R-764; chemical formula is SO,. Cylinder color code, black: boiling point at atmospheric pressure 14°F.
Sump:	A tank or pit which receives liquid wastes only, located below the elevation of the gravity system and which shall be emptied by pumping.
Sump Drainage:	A liquid or air tight tank which receives sewage and/or liquid waste located below the elevation of the gravity system, and which shall be emptied by pumping.
Sump Pump:	A permanently installed mechanical device other than an ejector for removing liquid waste from a sump.

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Superheat:	Temperature of vapor above boiling temperature of its liquid at that pressure.
Superheater (Cooling):	Heat exchanger arranged to cool liquid going to evaporator using this heat to superheat vapor leaving evaporator.
Superheater (Heating):	Devices that add heat to saturated fluids.
Supplementary Natural Gas:	Gases which are manufactured to duplicate natural gas.
Supply Branch:	The piping used to supply heated water from a main, circuit main, or trunk to the terminal unit.
Supply Main:	The pipe used to distribute water from the boiler to the supply branches of the terminal units.
Supply Piping:	That portion of the piping system that carries water from the boiler to the terminal units or to the point of use.
Supply lapping:	The opening in a boiler into which the supply main is connected.
supports:	Devices for supporting and securing pipe, fixtures, and equipment.
Surface Plate:	Tool with a very accurate flat surface, used for measuring purposes, and for lapping flat surfaces.
Surge:	Modulating action of temperature or pressure before it reaches its final value or setting.
Surge Tank:	Container connected to a refrigerating system which increases gas volume and reduces rate of pressure change.
Swash Plate-Wobble Plate:	Device used to change rotary motion to reciprocating motion, used in some refrigeration compressors.
Sweating:	This term is used two different ways in refrigeration work: (1) condensation of moisture from air on cold surface; (2) method of soldering in which the parts to be joined are first coated with a thin layer of solder.
Switch, Air plow:	A device used to prove the flow of air.
Switch, High Oil Temperature:	A temperature-actuated device arranged to cause the safety shutdown of a preheated oil burner or to prevent it from starting when the fuel oil temperature rises above a set point which shall be the upper end of the viscosity range recommended by the burner manufacturer.
Switch, High-Pressure:	A pressure-actuated device to monitor liquid, steam, or gas pressure and arranged to shut down the burner at a preset high-pressure.
Switch, Low Oil Temperature:	A temperature-actuated device arranged to shutdown a preheated oil burner or to prevent it from starting when the fuel oil temperature falls below a set point which shall be the lower end of the viscosity range recommended by the burner manufacturer.

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Switch, Low-Pressure:	A pressure-actuated device to monitor liquid, steam, or gas pressure and arranged to shut down the burner at a preset low-pressure.
Switch, Pressure:	A pressure-responsive device that makes or breaks an electrical circuit and may be automatically or manually reset.
Sylphon Seal:	Corrugated metal tubing used to hold seal ring and provide leak-proof connection between seal ring and compressor body or shaft.
System Fuel Train:	A series of valves, regulators, and controls, between the burner and the source of fuel, that regulates and controls the flow of fuel to the burner.
Systems Testing Adjusting & Balancing:	(1) The balance of air and water distribution; (2) adjustment of total system to provide design quantities; (3) electrical measurement; (4) verification of performance of all equipment and automatic controls; (5) sound and vibration measurement.
Tamper Switch:	A switch which causes a trouble or supervisory signal if an equipment cover or valve is opened.
Tankless Water Heater:	An indirect water heater designed to operate without a hot water storage tank in the system. Is also called an instantaneous heater.
Temperature Humidity Index:	Actual temperature and humidity of air sample, compared to air at standard conditions.
Terminal:	The point where the controlled fluid enters or leaves the distribution system. These are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.
Terminal Units:	That part of a hydronic system in which heat is transferred from the water to the air in the air conditioned space. Common terminal units include radiators, convectors, baseboard, unit heaters, finned tube, etc. Devices located near the conditioned space that regulate the temperature and/or volume of supply air to the space.
Test:	To determine quantitative performance of equipment,
Therm:	A unit of heat having a value of 100,000 BTU.
Thermal Conductivity:	A term indicating the ability of a material to transmit heat. Thermal conductivity is the reciprocal of thermal resistance.
Thermal Head:	The head produced by the difference in height of the heated water in the supply side of the system and the cooler water in the return side. This is the only head available to cause circulation of water in a gravity system.

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Thermal Lag:	The time interval before the temperature of the water leaving the influence of the cooling air is detected at the point of cold water temperature measurement.
Thermal Radiation:	The transmission of heat from a hot surface to a cooler one in the form of invisible electromagnetic waves which on being absorbed by the cooler surface, raises the temperature of that surface.
Thermal Relay (Hot Wire Relay):	Electrical control used to actuate a refrigeration system. This system uses a wire to convert electrical energy into heat energy.
Thermal Resistance:	The resistance a material offers to the transmission of heat. Insulating materials have high thermal resistance. Materials such as metals have low thermal resistance.
Thermistor:	Material called a semiconductor, that is between a conductor and an insulator, and has electrical resistance that varies with temperature.
Thermocouple:	Device which generates electricity, using the principle that if two dissimilar metals are welded together and junction is heated, a Voltage will develop across open ends.
Thermocouple Thermometer:	Electrical instrument using thermocouple as source of electrical flow, connected to milliammeter calibrated in temperature degrees.
Thermodisk Defrost Control:	Electrical switch with bimetal disk which is controlled by electrical energy.
Thermodynamics:	Science which deals with mechanical action or relations of heat.
Thermoelectric Refrigeration:	A refrigerator mechanism which depends on Peletier effect. Direct current flowing through electrical junction between dissimilar metals provides heating or cooling effect depending on direction of flow of current.
Thermometer:	Device for measuring temperatures.
Thermomodule:	Number of thermocouples used in parallel to achieve low temperatures.
Thermostat:	Device responsive to ambient temperature conditions. A control (switch) that is operated by the air temperature.
Thermostatic Control:	Device that operates system or part of system based on temperature changes.
Thermostatic Expansion Valve:	A control valve operated by temperature and pressure within evaporator coil, that controls flow of refrigerant. Control bulb is attached to outlet of coil.
Thermostatic Motor Control:	Device used to control cycling of unit through use of control bulb attached to evaporator.
Thermostatic Valve:	Valve controlled by thermostatic elements.

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Thermostatic Water Valve:	Valve used to control water flow through system, actuated by temperature difference, used in units such as water-cooled compressor or condenser.
Throttling:	Expansion of gas through orifice or controlled opening without gas performing any work in expansion process.
Tie Rod:	The sections of cast-iron sectional boilers are held in tight contact by means of tie rods that pass entirely through the sections.
Time Delay.	A deliberate delay of a predetermined time in the action of a safety device or control.
Timer-Thermostat:	Thermostat control that includes a clock mechanism. Unit automatically controls room temperature and changes it according to time of day.
Timers:	Mechanism used to control on and off times of an electrical circuit.
Ton of Refrigeration:	Refrigerating effect equal to the melting of one ton of ice in 24 hours. This may be expressed as follows: 288,000 BTU/24 hr, 12,000 BTU/l hr, 200 BTU/min.
Ton Refrigeration Unit:	Unit which removes same amount of heat in 24 hours as melting of one ton of ice.
Torque:	Turning or twisting force.
Total Air:	The total amount of air supplied to a burner. It is the sum of primary, secondary, and excess air.
Total Pressure:	Also called impact pressure. The pressure measured in a moving fluid by an impact tube. It is the sum of the velocity pressure and the static pressure.
lower Pumping Head:	Total head of water at the center line of the circulating water inlet to the cooling tower. It is the sum of the static pressure measured at the centerline of the inlet connection to the cooling tower, the velocity pressure at this point, and the vertical distance between this point and the top of the basin curb.
Transducer:	Device actuated by power from one system and supplies power in another form to second system.
Transformer:	A device used to transfer alternating current energy from one circuit to another. A transformer consists of a pair of inductively coupled coils of wire, wound on a laminated metal core.
Transponder:	A receiver/transmitter activated for transmission by reception of a predetermined signal. “Transponder” is made up of parts of the words “Transmitter” and “responder”.
Trap:	A fitting or device which provides a liquid seal to prevent the passage of vapor or gases without materially affecting the flow of sewage or waste water through it.

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Trap Seal:	The maximum vertical depth of liquid that a trap will retain, measured between the crown weir and the top of the dip of the trap.
Trichlorotrifluoroethane:	Complete name of refrigerant R-l 13. Group 1 refrigerant in rather common use. Chemical compounds which make up this refrigerant are chlorine, fluorine, and ethane.
Trim:	Accessory piping connected to sprinkler valve.
Triple Point:	Pressure temperature condition in which a substance is in equilibrium in solid, liquid, and vapor states.
Tripping (Trip lest):	The operation of a dry pipe valve.
Trouble Signal:	A signal indicating an alarm system abnormal condition requiring correction for the alarm system be fully operational with all features.
Trunk (or Trunk Main):	The section of the main in a multiple circuit system that carries the combined capacity of two or more of the circuits.
lube, Constricted:	Tubing that is reduced in diameter.
Tube-Within-A-Tube:	A water-cooled condensing unit in which a small tube is placed inside large unit. Refrigerant passes through one tube; water through the other.
Tubing:	Fluid carrying pipe which has a thin wall.
Turndown:	The ratio of maximum to minimum input rates.
Two-Pipe System:	A hot-water heating system using one pipe from the boiler to supply heated water to the terminal units, and a second pipe to return the water from the terminal units back to the boiler.
Two-Temperature Valve:	Pressure opened valve used in suction line on multiple refrigerator installations that maintains evaporators in system at different temperatures.
Ultimate CO:	The percentage of carbon dioxide in dry combustion products when a fuel (gas) is completely burned with exactly the amount of air needed for complete combustion. This is the theoretical maximum CO, that can be obtained for a given gas in burning the gas in air.
Ultraviolet:	Invisible radiation waves with frequencies shorter than wave lengths of visible light and longer than X-Ray.
Unit Heater:	This term applies to a terminal unit designed to heat a given space. It consists of a fan and motor, a heating element, and an enclosure. (Also see fan coil.)
Unit Ventilator:	A terminal unit in which a fan is used to mechanically circulate air over the heating coil. These units are so constructed that both outdoor and room air may be circulated so as to provide ventilation as well as heat. These units may contain a cooling coil for summer operation.
Universal Motor:	Electric motor which will operate on both AC and DC.

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Universal Orifice:	A combination fixed and adjustable orifice designed for the use of two different gases, such as LPG and natural gas.
Up-Feed System:	A hydronic system in which the supply main is located below the level of the terminal units.
Updraft:	Excessively low air pressure existing at the outlet of a chimney or stack which tends to increase the velocity and volume of gases passing up the stack.
Utility Gases:	Natural gas, manufactured gas, liquefied petroleum gas-air mixtures or mixtures of any of these gases.
V-Belt:	Type of belt that is commonly used in mechanical equipment. It has a contact surface which is in the shape of the letter V.
V-Block:	V-shaped groove in metal block used to hold shaft.
Vacuum:	Reduction in pressure below atmospheric pressure.
Vacuum Breaker:	See backflow preventer.
Vacuum Pump:	Special high efficiency compressor used for creating high vacuums for testing or drying purposes.
Vacuum Relief Valve:	A device to prevent excess vacuum in a pressure vessel.
Valve, Automatic:	An automatic device consisting essentially of a valve and operator that controls the fuel supply to the burner(s) during normal operation of a boiler. It may be actuated by application of electrical, mechanical, or other means.
Valve, Lubricated Plug Type:	A valve of the plug and barrel type designed for maintaining a lubricant between the bearing surfaces.
Valve, Modulating Control:	A valve designed to regulate fuel input to the burner in response to demand.
Valve, Proof of Closure:	A safety shutoff valve equipped with an interlock switch that will be actuated only after the valve has fully closed.
Valve, Safety Shutoff:	A fast-closing valve that automatically and completely shuts off the fuel supply in response to a normal or safety shutdown signal.
Valve Plate:	Part of compressor located between top of compressor body and head that contains compressor valves.
Valve, Service:	Device used by service technicians to check pressures and charge refrigerating units.
Valve, Solenoid:	Valve actuated by magnetic action by means of an electrically energized coil.
Valve, Suction:	Valve in refrigeration compressor that allows vaporized refrigerant to enter cylinder from suction line and prevents its return.

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Valve, Expansion: Type of refrigerant control that maintains pressure difference high-side and low-side pressure in refrigerating mechanism. Valve is caused to operate by pressure in low or suction side. Often referred to as an automatic expansion valve (AEV).

Valves, Water: Most water cooling units are supplied with water valves. These valves provide a flow of water to cool the system while it is running. Most water valves are controlled by solenoids.

Vapor: The gaseous form of a substance that under other conditions of pressure and/or temperature is a solid or a liquid.

Vapor Barrier: A material that is impervious to the passage of water vapor through it. Thin plastic or metal foil sheet used in air conditioned structures to prevent water vapor from penetrating insulating material.

Vapor Charged: Lines and component parts of system which are charged at the factory.

Vapor Lock: Condition where liquid is trapped in-line because of bend or improper installation that prevents the vapor from flowing.

Vapor Pressure: Pressure imposed by either a vapor or gas.

Vapor Pressure Curve: Graphic presentation of various pressures produced by refrigerant under various temperatures.

Vapor, Saturated: A vapor condition that will result in condensation into droplets of liquid as vapor temperature is reduced.

Variable, Air Volume: An air distribution system capable of automatically delivering a reduced volume of constant temperature cool air to satisfy the reduced cooling load of individual zones.

Variable, Pitch Pulley: Pulley which can be adjusted to provide different pulley ratios.

Velotimeter: Instrument used to measure air velocities using a direct reading air speed indicating dial.

Velocity: A vector quantity that denotes at once the time rate and the direction of motion, $V = ds/dt$. For a uniform linear motion $V = s/t$. Common units are feet per second or feet per minute.

Velocity Pressure: Pressure exerted by a flowing gas by virtue of its movement in the direction of its motion. It is the difference between total pressure and static pressure.

Vent: A device, such as a pipe, to transmit flue products from an appliance to the outdoors. This term also is used to designate a small hole or opening for the escape of a fluid (such as in a gas control). Piping used to permit air to escape from hydronic systems, condensate receivers, fuel oil storage tanks, as a breather line for gas regulators, etc.

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Vent Gases:	Products of combustion from gas appliances plus excess air; plus dilution air in the venting system above a draft hood.
Vent tine:	A line used to convey leakage gases to a safe point of discharge.
Vent System:	A pipe or pipes installed to provide air-flow to or from a drainage system, or to provide air-circulation within such system to protect trap seals from siphonage and back pressure.
Vent Valve:	A normally open, power-closed valve, piped between the two safety shutoff valves, vented to a safe point of discharge.
Ventilation:	The introduction of outdoor air into a building by mechanical means.
Venturi:	A constricted portion of a pipe or tube that increases water velocity, thus momentarily reducing its pressure.
Viscosity:	Term used to describe resistance of flow of fluids.
Volatile Liquid:	Liquid which evaporates at low-temperature and pressure.
Voltage Control:	It is necessary to provide some electrical circuits with uniform or constant Voltage. Electronic devices used for this purpose are called Voltage controls.
Voltage:	Electrical potential difference, usually expressed in Volts.
Voltmeter:	Instrument for measuring Voltage action in electrical circuit.
Volume (Specific):	The volume of a substance per unit mass: the reciprocal of density. Units: cubic feet per pound, cubic centimeters per gram, etc.
Volumetric Efficiency:	Term used to express the relationship between the actual performance of a compressor or vacuum pump, and the calculated pump performance based on its displacement versus its actual pumping ability.
Volute:	The spiral cavity formed by pump casing surrounding the pump impeller.
vortex Tube:	Mechanism for cooling or refrigerating that accomplishes cooling effect by releasing compressed air through a specially designed opening. Air expands in a rapidly spiraling column of air which separates slow moving molecules (cool) from fast moving molecules (hot).
Vortex Tube Refrigeration:	Refrigerating or cooling devices using principle of vortex tube as in mining.
Walk-In Cooler:	Large commercial refrigerated space kept below room temperature. Often found in large supermarkets or wholesale meat distribution centers.
Water Column (W.C.):	A unit used for expressing pressure. One inch water column equals a pressure of 0.578 oz/in.

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Water Cooled Condenser:	A condensing unit that is cooled through water use,
Water Defrosting:	Use of water to melt ice and frost from evaporator during off-cycle.
Water Hammer:	Pressure rise in a pipeline caused by a sudden change in the flow-rate or flow-stoppage in the line.
Water Heater:	A closed vessel in which water is heated by the combustion of fuels, electricity, or any other source, and withdrawn for use external to the system at pressures not exceeding 160 psig (1100 kPa gauge), and shall include the apparatus by which heat is generated and all controls and devices necessary to prevent water temperatures from exceeding 21 0°F (99°C).
Water Service Pipe:	The pipe from the water main or other source of potable water supply to the water distributing system of the building serviced.
Water Supply System:	The water service pipe, the water distributing pipes, and all the necessary connecting pipes, fittings, control valves and all appurtenances in or adjacent to the building or premises.
Water Temperature Control Valve:	A valve of the pressure balance, thermostatic mixing, or combination pressure balance/thermostatic mixing type that is designed to control water temperature to reduce risk of scalding.
Water lube Boiler:	A steel, hot-water boiler in which the water is circulated through the tubes, and the hot gases from combustion of the fuel are circulated around the tubes inside the shell.
Wet Bulb:	Device used in measurement of relative humidity. Evaporation of moisture lowers temperature of wet bulb compared to dry bulb temperature in same area.
Wet Cell Battery:	Cell or connected group of cells that converts chemical energy into electrical energy by reversible chemical reactions.
Wet Pipe System:	A sprinkler system which contains pressurized water at all times. Water discharges upon the operation of automatic sprinklers.
Wet-Bulb Temperature:	The temperature indicated by a properly designed wet-bulb instrument. This closely approximates the thermodynamic wet-bulb temperature, i.e., temperature of adiabatic saturation.
Windage:	Wind induced loss of circulating water.
Window Unit:	Commonly used when referring to air conditioners placed in a window. Normally a domestic application.

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Zone: That portion of a hydronic system whose operation is controlled by a single thermostat. An area or division of a building protected by one fire alarm initiating circuit. Sometimes the area and the circuit are referred to interchangeably as the zone. The fire alarm initiating circuit may be connected to represent a certain group of initiating devices instead of a particular area or division of the building.

Zone Valve: A valve, the operation of which is controlled by a thermostat. They are used in hydronic systems to control the flow of water in localized parts of the system, thus making it possible to independently control the temperature in different zones, or areas, of the building.

Zoned **System:** A hydronic system in which more than one thermostat is used. This permits independent control of room air temperature at more than one location.

APPENDIX B

END OF SUBSECTION

APPENDIX C

TECHNICAL BULLETINS/UPDATES/ADVISORIES

INDEX OF BULLETINS/ADVISORIES FOLLOWED BY

BULLETINS/ADVISORIES AS DEVELOPED

APPENDIX C

TECHNICAL ADVISORY T0501-1

DATE: 10/91
SYSTEM: Roofing (CSI 07000)
ASSEMBLY: Built-Up (CSI 07510)
SUBJECT: Roof Top Lighting and Insect Damage

"In March, 1988 a professional roofing magazine article described a bizarre but apparently avoidable, phenomenon. In about a dozen documented cases ranging from Washington State to Florida, beetles have bored through roof membranes, causing leaks. It was determined that the beetles are attracted to lights (especially mercury vapor) mounted on, over, or near roof surfaces, including nearby billboard lighting. Falling to the roof, they burrow into the roof substrate, seeking protection from the sun during the day. The types of roof membrane affected were asphaltic BUR, modified bitumen, and single-ply roofing. Evidently, no instance has yet been found among coal tar BUR. It is advisable to exercise care in the selection of roof membranes where billboards may exist adjacent to a planned roof installation, or when rooftop lighting is required. The roof specifier should discuss the types of luminaire to be used with project electrical engineers before mercury vapor fixtures are specified."

Source: Roofing Design Criteria Options. R.D. Herbert II

EXAMPLE: TECHNICAL ADVISORY BULLETIN

END OF SUBSECTION

APPENDIX D

REVISIONS SUMMARY

AT A GLANCE SUMMARY OF ALL

REVISIONS UP TO LATEST REVISION DATE

APPENDIX D

END OF SUBSECTION