CONTINUED FROM SHEET P702

2.4 CHECK VALVES

A. SILENT CHECK VALVE:
1. INSTALL SILENT CHECK VALVES IN ALL PUMP DISCHARGE.
2. PIPING LESS THAN 2-INCH: 300 POUNDS, BRONZE BODY, RENEWABLE BRONZE DISC SCREWED OR SWEAT ENDS, BRONZE TRIM, MUELLER #203 BP; OR EQUAL.
3. PIPING 2-INCH AND LARGER: 125 POUNDS, GLOBE TYPE IRON BODY, BRONZE TRIM, RENEWABLE SEAT AND DISC, SS SPRINGS, MUELLER #105-AP; OR EQUAL.

B. SWING CHECK VALVE:
1. 2-INCH AND SMALLER: 125 PSI VALVES FOR DOMESTIC HOT AND COLD WATER.
a. MSS SP-80; CLASS 125, CAST-BRONZE BODY AND CAP CONFORMING TO ASTM B62; WITH HORIZONTAL SWING, Y-PATTERN, AND BRONZE DISC; AND HAVING THREADED OR SOLDER ENDS.
b. PROVIDE VALVES CAPABLE OF BEING REGROUND WHILE THE VALVE REMAINS IN THE LINE.
c. PROVIDE CLASS 150 VALVES MEETING THE ABOVE SPECIFICATIONS, WITH THREADED END CONNECTIONS, WHERE SYSTEM PRESSURE REQUIRES OR WHERE CLASS 125 VALVES ARE NOT AVAILABLE.
2. 2-1/2-INCH AND LARGER FOR DOMESTIC HOT AND COLD WATER, HEATING HOT WATER:
a. MSS SP-71; CLASS 125 CAST IRON BODY AND BOLTED CAP CONFORMING TO ASTM A126, CLASS B; HORIZONTAL SWING, AND BRONZE DISC OR CAST-IRON DISC WITH BRONZE DISC RING; AND FLANGED ENDS.
b. PROVIDE VALVES CAPABLE OF BEING REFITTED WHILE THE VALVE REMAINS IN THE LINE.

PART 3 - EXECUTION

3.1 INSTALLATION

A. INSTALL VALVES IN CONFORMANCE WITH:
1. THE SHOP DRAWINGS REVIEWED BY ENGINEER.
2. THE MANUFACTURER'S RECOMMENDATIONS.

B. INSTALL VALVES:
1. AT ALL BRANCH PIPING CONNECTION TO MAINS.
2. AT ALL CONNECTIONS TO EQUIPMENT.
3. AS REQUIRED FOR COMPLETE CONTROL OR ISOLATION OF ANY PIECE OF EQUIPMENT OR SERVICE TO BRANCH LINES.
4. IN ACCESSIBLE LOCATIONS.
5. EQUAL IN FLOW AREA TO CONNECTING PIPING, UNLESS OTHERWISE INDICATED.

C. NO VALVE SHALL BE INSTALLED WITH ITS STEM BELOW THE HORIZONTAL.

D. INSTALL FLANGED VALVES AT EQUIPMENT IN A MANNER WHICH ALLOWS EQUIPMENT SIDE OF VALVE TO BE OPENED UP WITHOUT DRAINING PIPING SYSTEM.

END OF SECTION 22 05 23

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. DRAWINGS AND GENERAL PROVISIONS OF THE CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS AND DIVISION 01 SPECIFICATION SECTIONS, APPLY TO THIS SECTION.

1.2 SUMMARY

A. THIS SECTION INCLUDES THE FURNISHING AND INSTALLATION OF ALL PIPE HANGING AND SUPPORT SYSTEMS.

1.3 REFERENCES

A. EXCEPT AS HEREIN SPECIFIED OR AS INDICATED ON THE DRAWINGS, THE WORK OF THIS SECTION SHALL COMPLY WITH THE FOLLOWING:
1. ASME - AMERICAN SOCIETY OF MECHANICAL ENGINEERS:
a. B31.5 - BUILDING SERVICES PIPING.
b. B31.8 - GAS TRANSMISSION AND DISTRIBUTION PIPING SYSTEMS.
2. MSS - MANUFACTURERS STANDARDIZATION SOCIETY:
a. SP-58 - PIPE HANGERS AND SUPPORTS - MATERIALS, DESIGN AND MANUFACTURE.
b. SP-69 - PIPE HANGERS AND SUPPORTS - SELECTION AND APPLICATION - 1996.
c. SP-90 - GUIDELINES ON TERMINOLOGY FOR PIPE HANGERS AND SUPPORTS.

1.4 DEFINITIONS

A. PIPE RESTRAINT: PIPE SUPPORTING ELEMENT WHICH IS DESIGNED TO LIMIT OR DIRECT PIPE MOVEMENT DUE TO INTERNAL STATIC PRESSURE, GRAVITATIONAL FORCES, FRICTIONAL FORCES FROM HANGERS, ROLLERS, AND GUIDES, AND FORCES FROM EXPANSION COMPENSATION DEVICES:
1. PIPE RESTRAINTS ARE NOT DESIGNED TO RESTRAIN PIPE MOVEMENT CAUSED BY THERMAL EXPANSION, SHOCK OR SURGE.

B. PIPE GUIDE: A PIPE RESTRAINT DESIGNED TO DIRECT PIPE MOVEMENT ALONG A SINGLE AXIS.

C. PIPE ANCHOR: A PIPE RESTRAINT DESIGNED TO PROVIDE A STATIC POINT ABOUT WHICH PIPE MOVEMENT NORMALLY OCCURS, BY LIMITING THE LONGITUDINAL AND AXIAL MOVEMENT AT THAT POINT.

D. OTHER TERMS: AS DEFINED IN MSS SP-90.

1.5 DESIGN AND PERFORMANCE REQUIREMENTS

A. UNLESS OTHERWISE INDICATED ON DRAWINGS OR IN THESE SPECIFICATIONS, THIS CONTRACTOR SHALL BE RESPONSIBLE TO DESIGN AND PROVIDE ALL PIPE HANGERS, SUPPORTS, RESTRAINTS, BRACES, FRAMING, ETC., AS REQUIRED TO COMPLY WITH ALL APPLICABLE BUILDING CODES, ASME B31 AND MSS SP-69.

B. COMPLY WITH THE REQUIREMENTS OF DIVISION 22 SECTION "SOUND AND VIBRATION CONTROL FOR PLUMBING" FOR VIBRATION ISOLATION OF PIPING.

C. COMPLY WITH THE REQUIREMENTS OF DIVISION 21 SECTION "WATER BASED FIRE SUPPRESSION SYSTEMS" FOR PIPE HANGERS AND SUPPORTS FOR FIRE PROTECTION PIPING.

D. COMPLY WITH THE REQUIREMENTS OF ASME B31.8 FOR PIPE HANGERS AND SUPPORT OF NATURAL GAS PIPING SYSTEMS.

E. THE WORK IN THIS SECTION INCLUDES RESPONSIBILITY FOR ALL HANGERS, SUPPORTS, RESTRAINTS, BRACES, FRAMING, ETC. AS REQUIRED TO COMPLY WITH THE SEISMIC RESTRAINT REQUIREMENTS OF THE 2018 INTERNATIONAL BUILDING CODE.

1.6 SUBMITTALS

A. MANUFACTURER'S LITERATURE: FOR STRUCTURAL STEEL ATTACHMENT DEVICES, HANGERS AND ROLLERS. INCLUDE NAME OF MANUFACTURER, MODEL NUMBER AND MSS TYPE, IF APPLICABLE; AND PIPING SYSTEMS TO BE USED WITH.

B. SUBMIT SHOP DRAWINGS FOR ALL ENGINEERED HANGER, RESTRAINTS AND SUPPORT ASSEMBLIES.

C. UPON REQUEST BY ENGINEER, SUBMIT CALCULATIONS FOR ALL ENGINEERED HANGER, RESTRAINTS AND SUPPORT ASSEMBLIES.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. THE MATERIALS OF ALL PIPE HANGING AND SUPPORTING ELEMENTS SHALL BE IN ACCORDANCE WITH THE LATEST REQUIREMENTS OF THE ASME CODE FOR PRESSURE PIPING B31.1 AND MSS STANDARD PRACTICE MSS SP-58 AND MSS SP-69 EXCEPT AS SUPPLEMENTED OR MODIFIED BY THE REQUIREMENTS OF THESE SPECIFICATIONS.

B. THE MATERIAL IN CONTACT WITH THE PIPE SHALL BE COMPATIBLE WITH THE PIPING MATERIAL SO THAT NEITHER SHALL HAVE A DETERIORATING ACTION ON THE OTHER.

C. SPECIAL FINISHES AND MATERIALS:
1. ALL FERROUS HANGERS AND SUPPORTS USED IN THE FOLLOWING AREAS SHALL BE HOT DIP GALVANIZED UNLESS NOTED OTHERWISE:
a. OUTSIDE.
b. IN WET OR POTENTIALLY WET AREAS.
2. STAINLESS STEEL HANGERS AND SUPPORTS SHALL BE USED WHERE EXPOSED IN KITCHENS AND OTHER FOOD PREPARATION AREAS.

2.2 MANUFACTURERS

A. ELCON.
B. ANVIL.
C. HILTI.

2.3 PIPE HANGERS AND SUPPORTS

A. HORIZONTAL PIPING HANGERS: UNLESS OTHERWISE INDICATED AND EXCEPT AS SPECIFIED IN PIPING SYSTEM SPECIFICATION SECTIONS, INSTALL THE FOLLOWING TYPES:
1. ADJUSTABLE STEEL CLEVIS HANGERS (MSS TYPE 1): FOR SUSPENSION OF NONINSULATED OR INSULATED STATIONARY PIPES, NPS 1/2 TO NPS 30 (DN15 TO DN750).
2. YOKE TYPE PIPE CLAMPS (MSS TYPE 2): FOR SUSPENSION OF 120 TO 450 DEGREES F (49 TO 232 DEGREES C) PIPES, NPS 4 TO NPS 16 (DN100 TO DN400), REQUIRING UP TO 4 INCHES (100 MM) OF INSULATION.
3. CARBON OR ALLOY STEEL, DOUBLE BOLT PIPE CLAMPS (MSS TYPE 3): FOR SUSPENSION OF PIPES, NPS 3/4 TO NPS 24 (DN20 TO DN600), REQUIRING CLAMP FLEXIBILITY AND UP TO 4 INCHES (100 MM) OF INSULATION.
4. STEEL PIPE CLAMPS (MSS TYPE 4): FOR SUSPENSION OF COLD AND HOT PIPES, NPS 1/2 TO NPS 24 (DN15 TO DN600), IF LITTLE OR NO INSULATION IS REQUIRED.
5. PIPE HANGERS (MSS TYPE 5): FOR SUSPENSION OF PIPES, NPS 1/2 TO NPS 4 (DN15 TO DN100), TO ALLOW OFF-CENTER CLOSURE FOR HANGER INSTALLATION BEFORE PIPE ERECTION.
6. ADJUSTABLE SWIVEL SPLIT OR SOLID RING HANGERS (MSS TYPE 6): FOR SUSPENSION OF NONINSULATED STATIONARY PIPES, NPS 3/4 TO NPS 8 (DN20 TO DN200).
7. ADJUSTABLE STEEL BAND HANGERS (MSS TYPE 7): FOR SUSPENSION OF NONINSULATED STATIONARY PIPES, NPS 1/2 TO NPS 8 (DN 15 TO DN200).
8. ADJUSTABLE BAND HANGERS (MSS TYPE 9): FOR SUSPENSION OF NONINSULATED STATIONARY PIPES, NPS 1/2 TO NPS 8 (DN15 TO DN200).
9. ADJUSTABLE SWIVEL RING BAND HANGERS (MSS TYPE 10): FOR SUSPENSION OF NONINSULATED STATIONARY PIPES, NPS 1/2 TO NPS 2 (DN15 TO DN50).
10. SPLIT PIPE RING WITH OR WITHOUT TURNBUCKLE ADJUSTMENT HANGERS (MSS TYPE 11): FOR SUSPENSION OF NONINSULATED STATIONARY PIPES, NPS 3/8 TO NPS 8 (DN10 TO DN200).
11. EXTENSION HINGED OR 2 BOLT SPLIT PIPE CLAMPS (MSS TYPE 12): FOR SUSPENSION OF NONINSULATED STATIONARY PIPES, NPS 3/8 TO NPS 3 (DN10 TO DN80).
12. U-BOLTS (MSS TYPE 24): FOR SUPPORT OF HEAVY PIPE, NPS 1/2 TO NPS 30 (DN15 TO DN750).
13. CLIPS (MSS TYPE 26): FOR SUPPORT OF INSULATED PIPES NOT SUBJECT TO EXPANSION OR CONTRACTION.

B. SUPPORTS AND ROLLERS:
1. PIPE SADDLE SUPPORTS (MSS TYPE 36): FOR SUPPORT OF PIPES, NPS 4 TO NPS 36 (DN100 TO DN900), WITH STEEL PIPE BASE STANCHION SUPPORT AND CAST IRON FLOOR FLANGE.
2. PIPE STANCHION SADDLES (MSS TYPE 37): FOR SUPPORT OF PIPES, NPS 4 TO NPS 36 (DN100 TO DN900), WITH STEEL PIPE BASE STANCHION SUPPORT AND CAST IRON FLOOR FLANGE WITH U-BOLT TO RETAIN PIPE.
3. ADJUSTABLE PIPE SADDLE SUPPORTS (MSS TYPE 38): FOR STANCHION TYPE SUPPORT FOR PIPES, NPS 2-1/2 TO NPS 36 (DN65 TO DN900), IF VERTICAL ADJUSTMENT IS REQUIRED, WITH STEEL PIPE BASE STANCHION SUPPORT AND CAST IRON FLOOR FLANGE.
4. SINGLE PIPE ROLLS (MSS TYPE 41): FOR SUSPENSION OF PIPES, NPS 1 TO NPS 30 (DN25 TO DN750), FROM 2 RODS IF LONGITUDINAL MOVEMENT CAUSED BY EXPANSION AND CONTRACTION MIGHT OCCUR.
5. ADJUSTABLE ROLLER HANGERS (MSS TYPE 43): FOR SUSPENSION OF PIPES, NPS 2-1/2 TO NPS 20 (DN65 TO DN500), FROM SINGLE ROD IF HORIZONTAL MOVEMENT CAUSED BY EXPANSION AND CONTRACTION MIGHT OCCUR.
6. COMPLETE PIPE ROLLS (MSS TYPE 44): FOR SUPPORT OF PIPES, NPS 2 TO NPS 42 (DN50 TO DN1050), IF LONGITUDINAL MOVEMENT CAUSED BY EXPANSION AND CONTRACTION MIGHT OCCUR BUT VERTICAL ADJUSTMENT IS NOT NECESSARY.
7. PIPE ROLL AND PLATE UNITS (MSS TYPE 45): FOR SUPPORT OF PIPES, NPS 2 TO NPS 24 (DN50 TO DN600), IF SMALL HORIZONTAL MOVEMENT CAUSED BY EXPANSION AND CONTRACTION MIGHT OCCUR AND VERTICAL ADJUSTMENT IS NOT NECESSARY.
8. ADJUSTABLE PIPE ROLL AND BASE UNITS (MSS TYPE 46): FOR SUPPORT OF PIPES, NPS 2 TO NPS 30 (DN50 TO DN750), IF VERTICAL AND LATERAL ADJUSTMENT DURING INSTALLATION MIGHT BE REQUIRED IN ADDITION TO EXPANSION AND CONTRACTION.

C. VERTICAL PIPING CLAMPS: UNLESS OTHERWISE INDICATED AND EXCEPT AS SPECIFIED IN PIPING SYSTEM SPECIFICATION SECTIONS, INSTALL THE FOLLOWING TYPES:
1. EXTENSION PIPE OR RISER CLAMPS (MSS TYPE 8): FOR SUPPORT OF PIPE RISERS, NPS 3/4 TO NPS 20 (DN20 TO DN500).
2. CARBON OR ALLOY STEEL RISER CLAMPS (MSS TYPE 42): FOR SUPPORT OF PIPE RISERS, NPS 3/4 TO NPS 20 (DN20 TO DN500), IF LONGER ENDS ARE REQUIRED FOR RISER CLAMPS.

D. HANGER ROD ATTACHMENTS: UNLESS OTHERWISE INDICATED AND EXCEPT AS SPECIFIED IN PIPING SYSTEM SPECIFICATION SECTIONS, INSTALL THE FOLLOWING TYPES:
1. STEEL TURNBUCKLES (MSS TYPE 13): FOR ADJUSTMENT UP TO 6 INCHES (150 MM) FOR HEAVY LOADS.
2. STEEL CLEVISES (MSS TYPE 14): FOR 120 TO 450 DEGREE F (49 TO 232 DEGREE C) PIPING INSTALLATIONS.
3. SWIVEL TURNBUCKLES (MSS TYPE 15): FOR USE WITH MSS TYPE 11, SPLIT PIPE RINGS.
4. MALLEABLE IRON SOCKETS (MSS TYPE 16): FOR ATTACHING HANGER RODS TO VARIOUS TYPES OF BUILDING ATTACHMENTS.
5. STEEL WELDLESS EYE NUTS (MSS TYPE 17): FOR 120 TO 450 DEGREE F (49 TO 232 DEGREE C) PIPING INSTALLATIONS.

E. SPRING HANGERS AND SUPPORTS: UNLESS OTHERWISE INDICATED AND EXCEPT AS SPECIFIED IN PIPING SYSTEM SPECIFICATION SECTIONS, INSTALL THE FOLLOWING TYPES:
1. RESTRAINT CONTROL DEVICES (MSS TYPE 47): WHERE INDICATED TO CONTROL PIPING MOVEMENT.
2. SPRING CUSHIONS (MSS TYPE 48): FOR LIGHT LOADS IF VERTICAL MOVEMENT DOES NOT EXCEED 1-1/4 INCHES (32 MM).
3. SPRING CUSHION ROLL HANGERS (MSS TYPE 49): FOR EQUIPPING TYPE 42 ROLL HANGER WITH SPRINGS.
4. SPRING SWAY BRACES (MSS TYPE 50): TO RETARD SWAY, SHOCK, VIBRATION, OR THERMAL EXPANSION IN PIPING SYSTEMS.
5. VARIABLE SPRING HANGERS (MSS TYPE 51): PRESET TO INDICATED LOAD AND LIMIT VARIABILITY FACTOR TO 25% TO ABSORB EXPANSION AND CONTRACTION OF PIPING SYSTEM FROM HANGER.
6. VARIABLE SPRING BASE SUPPORTS (MSS TYPE 52): PRESET TO INDICATED LOAD AND LIMIT VARIABILITY FACTOR TO 25% TO ABSORB EXPANSION AND CONTRACTION OF PIPING SYSTEM FROM BASE SUPPORT.
7. VARIABLE SPRING TRAPEZE HANGERS (MSS TYPE 53): PRESET TO INDICATED LOAD AND LIMIT VARIABILITY FACTOR TO 25% TO ABSORB EXPANSION AND CONTRACTION OF PIPING SYSTEM FROM TRAPEZE SUPPORT.
8. CONSTANT SUPPORTS: FOR CRITICAL PIPING STRESS AND IF NECESSARY TO AVOID TRANSFER OF STRESS FROM ONE SUPPORT TO ANOTHER SUPPORT, CRITICAL TERMINAL OR CONNECTED EQUIPMENT. INCLUDE AUXILIARY STOPS FOR ERECTION, HYDROSTATIC TEST, AND LOAD ADJUSTMENT CAPABILITY. THESE SUPPORTS INCLUDE THE FOLLOWING TYPES:
a. HORIZONTAL (MSS TYPE 54): MOUNTED HORIZONTALLY.
b. VERTICAL (MSS TYPE 55): MOUNTED VERTICALLY.
c. TRAPEZE (MSS TYPE 56): TWO VERTICAL TYPE SUPPORTS AND 1 TRAPEZE MEMBER.

2.4 HANGER RODS

A. MINIMUM ROD DIAMETERS FOR RIGID ROD HANGERS SHALL BE AS SHOWN IN MSS SP-69 TABLE 4 (MINIMUM ROD DIAMETER FOR SINGLE RIGID ROD HANGERS) AND AS INDICATED IN PART 3 OF THESE SPECIFICATIONS.

B. HANGER RODS SHALL BE SUBJECT TO TENSILE LOADING ONLY. AT HANGER LOCATIONS WHERE LATERAL OR AXIAL MOVEMENT IS ANTICIPATED, SUITABLE LINKAGE SHALL BE PROVIDED TO PERMIT SWING.

C. ROD MATERIAL MUST BE COMPATIBLE WITH HANGER AND COMPLY WITH ABOVE. DO NOT FIELD CUT THREAD ON GALVANIZED ROD.

D. DO NOT USE PERFORATED STRAP.

E. MULTIPLE SUPPORTS:
1. HORIZONTAL BANKS OF PIPE MAY BE SUPPORTED ON A COMMON BASE MEMBER WITHOUT REGARD TO THE PIPE CENTERLINE ELEVATION.
2. IN THE SUPPORTING OF MULTIPLE PIPE RUNS, PROVISIONS SHALL BE MADE TO KEEP THE LINES IN THEIR RELATIVE LATERAL POSITIONS, USING CLAMPS OR CLIPS AS REQUIRED. LINES SUBJECT TO THERMAL EXPANSION SHALL BE FREE TO ROLL AXIALLY OR SLIDE.

2.5 SADDLES AND SHIELDS

A. ALL PIPING:
1. SADDLE: MSS TYPE 39 (GRINNELL #160-164), OR ANVIL FIGURE 162 OR 165.
2. SHIELD: MSS TYPE 40 (GRINNELL #167), PROVIDE AND INSTALL IN ACCORDANCE WITH MANUFACTURER'S SHIELD SIZE SELECTION TABLES.
3. THE CONTOUR OF THE SADDLE SHALL MATCH THE RADIUS OF THE PIPE INSULATION.

2.6 ALIGNMENT GUIDES

A. PROVIDE AT ALL EXPANSION LOOPS AND JOINTS:
1. AS INDICATED ON THE DRAWINGS.
2. AS REQUIRED TO MAINTAIN ALIGNMENT.
3. IN ACCORDANCE WITH EXPANSION JOINT MANUFACTURER'S ASSOCIATION RECOMMENDATIONS.

B. PIPE SLIDES AND GUIDES:
1. MANUFACTURER:
a. ADVANCED THERMAL SYSTEMS, INC.
b. AS APPROVED BY OWNER.
2. MODEL:
a. FIGURE 101-W FOR GUIDE WELD DOWN APPLICATIONS.
b. FIGURE 101-B FOR GUIDE BOLT DOWN APPLICATIONS.
c. FIGURE 201-W FOR SLIDE WELD DOWN APPLICATIONS.
d. FIGURE 201-B FOR SLIDE BOLT DOWN APPLICATIONS.
3. SIZE: APPROPRIATE FOR PIPE SIZE, INSULATION THICKNESS AND LENGTH OF TRAVEL.
4. MINIMUM LENGTH OF TRAVEL:
a. FOR THE FIRST 1/4 OF THE DISTANCE FROM THE ANCHOR TO THE EXPANSION JOINT -25% OF DESIGN TRAVEL LENGTH OF JOINT.
b. FOR THE SECOND 1/4 OF THE DISTANCE FROM THE ANCHOR TO THE EXPANSION JOINT -50% OF DESIGN TRAVEL LENGTH OF JOINT.
c. FOR THE THIRD 1/4 OF THE DISTANCE FROM THE ANCHOR TO THE EXPANSION JOINT -75% OF DESIGN TRAVEL LENGTH OF JOINT.
d. FOR THE LAST 1/4 OF THE DISTANCE FROM THE ANCHOR TO THE EXPANSION JOINT - DESIGN TRAVEL LENGTH OF JOINT +25%.

C. SPIDER TYPE GUIDES:
1. MANUFACTURERS:
a. ITT GRINNELL.
b. MICHIGAN HANGER.
c. KEFLEX.
2. MINIMUM 12 INCHES LONG.
3. GRINNELL P-SERIES, FIGURE 25[illegible] EQUAL.

2.7 FABRICATED STEEL SUPPORTS AND [illegible]

A. PROVIDE AS REQUIRED:
1. STEEL SHAPES AND PLATES.
2. BOLTS.
3. WELDS.

B. MATERIALS AND FABRICATION IN ACCORDANCE WITH:
1. AISC SPECIFICATION FOR THE DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS.
2. AISC CODE OF STANDARD PRACTICE FOR STEEL BUILDINGS AND BRIDGES, EXCEPT SECTION 4.2.1.).

C. DESIGN RESPONSIBILITY OF SUBCONTRACTOR.

D. PAINT ALL [illegible] FABRICATIONS:
1. AS SPECIFIED IN DIVISION 09 - FINISHES.
2. COLOR AS SELECTED BY OWNER AND ENGINEER.

2.8 MANUFACTURED METAL FRAMING SUPPORT SYSTEMS

A. ACCEPTABLE MANUFACTURERS:
1. BEE LINE.
2. ELCON.
3. SUPER STRUT INC.
4. UNISTRUT BUILDING SYSTEMS.

B. PROVIDE PRODUCTS FROM ONE MANUFACTURER.

C. CHANNEL (STANDARD APPLICATIONS):
1. MILD STRIP STEEL.
2. 12-GAGE MINIMUM MATERIAL.
3. FACTORY PAINTED EQUAL TO UNISTRUT PERMA-GREEN.
4. EQUAL TO UNISTRUT PART NO. P1000.

D. STAINLESS STEEL CHANNEL AND ACCESSORIES: FOR USE IN KITCHENS AND OTHER FOOD PREPARATION AREAS.
1. 304 OR 316 STAINLESS STEEL.
2. 12 GAGE MINIMUM MATERIAL.
3. EQUAL TO UNISTRUT PART NO. P1000SS.
4. ALL CLAMPS, SUPPORTS AND NUTS TO BE SIMILAR STAINLESS STEEL.

E. CLAMPS AND SUPPORTS:
1. BEAM CLAMP EQUAL TO UNISTRUT PART NO. P2785.
2. PIPE STRAP EQUAL TO UNISTRUT PART NO. P2558.
3. PIPE ROLLER EQUAL TO UNISTRUT PART NO. P2474.
4. ALL ITEMS FABRICATED IN MATERIAL EQUAL TO CHANNEL SPECIFICATIONS.
5. COPPER PIPES SUPPORTED ON METAL FRAMING SUPPORT CHANNELS SHALL BE PROTECTED FROM GALVANIC CORROSION BY SPECIAL INSULATORS BETWEEN THE PIPE CLAMP AND THE CHANNEL.

F. CLAMP NUTS:
1. ELECTRO-GALVANIZED STAINLESS STEEL FOR USE WITH STAINLESS STEEL AND FIBERGLASS PARTS.
2. MILD BAR STEEL FOR STANDARD APPLICATIONS.
3. CLASS 2 AMERICAN STANDARD THREADS.
4. EQUAL TO UNISTRUT PART NO. P1012.

2.9 BUILDING ATTACHMENTS

A. AS INDICATED ON THE DRAWINGS OR IN THE SPECIFICATIONS.

B. CONCRETE ATTACHMENTS:
1. PROVIDE GALVANIZED FINISH FOR ALL ATTACHMENTS USED IN WET OR POTENTIALLY WET AREAS.
2. PROVIDE STAINLESS STEEL BOLTS AND NUTS IN WET AND POTENTIALLY WET AREAS.
3. POURED CONCRETE:
a. USE CAST-IN-PLACE INSERTS OR BOLTED SURFACE MOUNTED ATTACHMENTS, AT CONTRACTOR'S OPTION.
b. EXPANSION STYLE ANCHORS ARE NOT PERMITTED ON PIPING SYSTEMS SUBJECT TO VIBRATION.
4. PRECAST CONCRETE TEES:
a. USE FITTINGS SPECIFICALLY DESIGNED FOR ATTACHMENT TO STEMS OF PRECAST TEES.
b. DRILLING IS NOT PERMITTED EXCEPT WHERE SPECIFICALLY APPROVED BY ENGINEER AND COORDINATED WITH PRECAST MANUFACTURER TO MISS EMBEDDED, PRESTRESSED STEEL STRANDS.
5. PRECAST CONCRETE PLANK:
a. USE TOGGLE BOLT ATTACHMENT AS INDICATED ON DRAWINGS.
b. ALTERNATIVELY, PROVIDE ADHESIVE ANCHOR, HILTI HY-20; OR AS APPROVED.
c. DRILLING IS NOT PERMITTED EXCEPT WHERE SPECIFICALLY APPROVED BY ENGINEER AND COORDINATED WITH PRECAST MANUFACTURER TO MISS EMBEDDED, PRESTRESSED STEEL STRANDS.

C. HORIZONTAL PIPING:
1. STEEL W, I, OR S SHAPES: MSS TYPE 23 CLAMP WITH RETAINING CLIP, (GRINNELL FIG. 87) UP TO 2-INCH; MSS TYPE 28 (GRINNELL FIG. 292) OR MSS TYPE 21 (GRINNELL FIG. 133, 134) ABOVE 2-INCH.
2. STEEL CHANNEL: MSS TYPE 20 UNIVERSAL CHANNEL CLAMP.
3. BAR JOISTS: STEEL WASHER PLATE (GRINNELL FIG. 60).
4. CONCRETE: SEE "B" ABOVE.
5. TIMBER: ANGLE BRACKET AND LAG SCREWS OR AS DETAILED ON DRAWINGS.

D. VERTICAL PIPING:
1. STEEL SHAPES: WELDED BRACKETS AS APPROVED BY ENGINEER.
2. CONCRETE: SEE "B" ABOVE.
3. TIMBER: CEILING HANGER FLANGE (GRINNELL FIG. 128R, 153) ANGLE BRACKETS AND LAG SCREWS, OR AS DETAILED ON DRAWINGS.

E. IN THE ABSENCE OF A SPECIFICATION FOR A PARTICULAR TYPE OF ATTACHMENT, FURNISH ATTACHMENTS COMPARABLE IN TYPE AND QUALITY TO THAT SPECIFIED ABOVE FOR A SIMILAR SITUATION.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. GENERAL REQUIREMENTS:
1. THE SELECTION OF PIPE HANGERS AND SUPPORTS SHALL BE BASED ON THE OVERALL DESIGN CONCEPT OF THE PIPING SYSTEM AND ANY SPECIAL REQUIREMENTS WHICH MAY BE CALLED FOR IN THESE SPECIFICATIONS OR AS INDICATED ON THE DRAWINGS. THE SUPPORT SYSTEMS SHALL PROVIDE FOR, AND CONTROL, THE FREE OR INTENDED MOVEMENT OF THE PIPING INCLUDING ITS MOVEMENT IN RELATION TO THAT OF THE CONNECTED EQUIPMENT. THEY SHALL PREVENT EXCESS STRESS RESULTING FROM THE TRANSFER OF WEIGHT BEING INTRODUCED INTO THE PIPE OR CONNECTED EQUIPMENT.
2. THE SELECTION OF HANGERS AND SUPPORTS SHALL BE MADE TO PROVIDE THE PIPING SYSTEM WITH THE DEGREE OF CONTROL THAT ITS OPERATING CHARACTERISTICS REQUIRE.
3. THE SELECTION OF HANGERS OR SUPPORTS WILL TAKE INTO CONSIDERATION THE COMBINED WEIGHT OF THE SUPPORTED SYSTEMS, INCLUDING SYSTEM CONTENTS AND TEST WATER.
4. SELECT AND INSTALL HANGERS AND SUPPORTS TO ALLOW CONTROLLED THERMAL AND SEISMIC MOVEMENT OF PIPING SYSTEM, TO PERMIT FREEDOM OF MOVEMENT BETWEEN PIPE ANCHORS, AND FACILITATE ACTION OF EXPANSION JOINTS, EXPANSION LOOPS, EXPANSION BENDS AND SIMILAR UNITS.
5. THE SPANS IN MSS SP-69 TABLE 3 DO NOT APPLY WHERE CONCENTRATED WEIGHTS, SUCH AS VALVES OR HEAVY FITTINGS, OR WHERE CHANGES IN DIRECTION OF THE PIPING OCCUR BETWEEN HANGERS.
6. SELECT ALL HANGERS AND SUPPORTS RATED FOR THE MAXIMUM POTENTIAL LOADING WITH PIPE FULL.
7. SELECT HANGERS FOR COLD (LESS THAN 50 DEGREES F) PIPING SERVICE FOR INSTALLATION OVER THE INSULATION.
8. WHERE SIGNIFICANT, VERTICAL MOVEMENT OF PIPE OCCURS AT THE HANGER LOCATION A RESILIENT SUPPORT MUST BE USED:
a. SELECTION OF RESILIENT SUPPORTS SHALL BE BASED ON PERMISSIBLE LOAD VARIATIONS AND EFFECTS ON ADJACENT EQUIPMENT. SUPPORT SELECTION FOR TYPICAL LOAD VARIATIONS ARE SHOWN ON MSS SP-69 TABLE 2 (SPRING SUPPORT SELECTION). LOAD AND MOVEMENT CALCULATIONS SHALL BE MADE FOR THE PROPER SELECTION OF SPRING HANGERS.
b. VERTICAL MOVEMENT AND LOAD TRANSFER FROM RISER EXPANSION TO HORIZONTAL RUNS SHALL BE GIVEN CONSIDERATION WHEN APPLYING SPRING HANGERS.
c. SPRING CUSHION HANGERS MAY BE USED WHERE VERTICAL MOVEMENT DOES NOT EXCEED 1/4-INCH AND WHERE FORMAL LOAD AND MOVEMENT CALCULATIONS ARE NOT REQUIRED.
d. VARIABLE SPRING HANGERS SHALL BE USED FOR ALL OTHER RESILIENT SUPPORT REQUIREMENTS EXCEPT AS NOTED IN THE FOLLOWING PARAGRAPH.
e. CONSTANT SUPPORT HANGERS SHALL BE USED ON PIPING SYSTEMS WHERE THE DEVIATION IN SUPPORTING FORCE MUST BE LIMITED TO 6% AND WHICH CANNOT BE ACCOMMODATED BY A VARIABLE SPRING HANGER.

B. COMPLY WITH MSS SP-69 FOR PIPE HANGER SELECTIONS AND APPLICATIONS THAT ARE NOT SPECIFIED IN PIPING SYSTEM SPECIFICATION SECTIONS.

3.2 HANGER AND SUPPORT INSTALLATION

A. PIPE HANGER AND SUPPORT INSTALLATION: COMPLY WITH MSS SP-69 AND MSS SP-89. INSTALL HANGERS, SUPPORTS, CLAMPS, AND ATTACHMENTS AS REQUIRED TO PROPERLY SUPPORT PIPING FROM BUILDING STRUCTURE.

B. GENERAL:
1. ADJUST ALL COMPONENTS AS REQUIRED FOR PROPER OPERATION AND REQUIRED PIPE SLOPE.
2. DOUBLE NUT ALL SUPPORT RODS AT HANGERS.
3. LOCATION AND ROUTING:
a. INSTALL PIPING AS INDICATED:
• ON THE DRAWINGS.
• ON THE REVIEWED SHOP DRAWINGS.
b. SECURE ENGINEER'S APPROVAL FOR ALL PIPE ROUTING CHANGES.
4. COORDINATE WITH OTHER TRADES FOR PLACEMENT OF CONCRETE ATTACHMENTS PRIOR TO CONCRETE POURING.
5. INSTALL ALL ITEMS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS.

C. SUPPORT AT VALVES: PROVIDE ADDITIONAL SUPPORTS AT ALL VALVES IN PIPING 4-INCH AND LARGER.

D. VERTICAL RISERS:
1. SUPPORT INDEPENDENTLY FROM ADJACENT HANGERS ON HORIZONTAL PIPING.
2. CAST IRON WASTE, VENT OR DRAINAGE PIPING:
a. SUPPORT AT THE BASE AND AT EACH FLOOR LEVEL.
b. SUPPORT SPACING NOT TO EXCEED 15-FOOT CENTERS.
3. COPPER PIPING:
a. SUPPORT AT THE BASE AND AT 6-FOOT MAXIMUM CENTERS FOR SIZES 1-1/4-INCH AND SMALLER.
b. PIPES LARGER THAN 1-1/4-INCH:
• SUPPORTED AT EACH FLOOR LEVEL.
• NOT TO EXCEED 10-FOOT CENTERS.
4. VERTICAL THREADED, WELDED OR GROOVED STEEL PIPING:
a. SUPPORT AT THE BASE OF THE RISER AND AT EVERY OTHER FLOOR.
b. MAXIMUM ALLOWABLE UNSUPPORTED PIPING LENGTH IS 12 FEET.
5. PLASTIC PIPING:
a. SUPPORT AT 4-FOOT CENTERS MAXIMUM FOR SIZES 1-1/2-INCH OR SMALLER.
b. SUPPORT AT THE BASE AND AT 4-FOOT CENTERS FOR ALL SIZES LARGER THAN 1-1/2 INCHES.
c. COMPLETELY ENCIRCLE COVERING AND INSULATING MATERIAL.

E. HORIZONTAL RUNS:
1. GENERAL:
a. PROVIDE ADEQUATE SUPPORTS FOR THE LOADS WITH A FACTOR OF SAFETY OF AT LEAST 5 [illegible] (MINIMUM).
b. PROVIDE PROTECTIVE SHIELD AT ALL HANGERS AND ROLLERS SUPPORTING PLASTIC PIPE AND CO[illegible].
c. SUPPORT SPACING NOT TO EXCEED MSS SP-69 TABLE 3, OR THE REQUIREMENTS FOR SEISMIC RESTRAINT, WHICHEVER IS MORE STRINGENT.
d. HANGER ROD DIAMETER SHALL NOT BE LESS THAN THE REQUIREMENTS OF MSS SP-69 TABLE 4, OR THE REQUIREMENTS FOR SEISMIC RESTRAINT, WHICHEVER IS MORE STRINGENT.
2. ROLLERS: ALL PIPING SYSTEMS DESIGNED TO ACCOMMODATE THERMAL EXPANSION MOVEMENT SHALL BE MOUNTED ON ROLLERS.
3. BAR JOISTS: ATTACHMENTS TO BAR JOISTS SHALL BE MADE TO TOP MEMBER AND AT PANEL POINTS.

F. DUCTILE IRON PIPING: THE SIZE OF HANGER COMPONENTS SHALL BE SUITABLE FOR THE O.D. OF THE PIPE TO BE SUPPORTED.

G. CAST IRON SOIL PIPING:
1. THE SIZE OF HANGER COMPONENTS SHALL BE SUITABLE FOR THE O.D. OF THE PIPE TO BE SUPPORTED.
2. SPACING SHALL COMPLY WITH MSS SP-69 TA[illegible].

3.3 PIPE RESTRAINTS

A. PROVIDE ADEQUATE PIPE RESTRAINTS FOR ALL EXPANSION OR CONTRACTION OF PIPING DUE TO TEMPERATURE CHANGE:
1. INCLUDING, BUT NOT LIMITED TO, THAT INDICATED ON THE DRAWINGS.
2. AS INSTRUCTED BY OWNER OR ENGINEER.
3. AT LOCATIONS TO PREVENT STRESSES FROM EXCEEDING THOSE PERMITTED BY ANSI B31 AND TO PREVENT TRANSFER OF LOADING AND STRESSES TO CONNECTED EQUIPMENT.
4. SPACING: UNLESS OTHERWISE INDICATED, INSTALL AT ENDS OF MAIN PIPE RUNS, AT INTERMEDIATE JOINTS IN PIPE RUNS BETWEEN EXPANSION LOOPS AND BENDS.

B. CONCRETE WORK INSTALLED IN CONNECTION WITH ANCHORS OR SUPPORTS: MAKE WITH APPROVED PORTLAND CEMENT:
1. AT LEAST 5-1/2 BAGS PER CUBIC YARD.
2. PROPERLY MIXED WITH APPROVED AGGREGATE.
3. ATTAIN A COMPRESSION STRENGTH OF NOT LESS THAN 3,[illegible] PSI AT 28 DAYS.

3.4 VIBRATION ELIMINATORS

A. PROVIDE AS INDICATED ON THE DRAWINGS AND IN ACCORDANCE WITH THE REQUIREMENTS OF DIVISION 22 SECTION "SOUND AND VIBRATION CONTROL FOR PLUMBING."

B. INSTALL SO AS TO CAUSE MINIMUM RESTRAINT TO NORMAL THERMAL MOVEMENTS.

3.5 INSULATION PROTECTION

A. PROVIDE PROTECTION SADDLE:
1. EQUAL TO INSULATION THICKNESS.
2. AT EACH HANGER.
3. FOR ALL INSULATED PIPING SYSTEMS WHERE LONGITUDINAL EXPANSION EXCEEDS 1-INCH PER 100 FEET.

B. PROVIDE PRESERVATIVE TREATED WOOD BLOCK "SADDLE" FOR ALL INSULATED DOMESTIC COLD WATER PIPING SYSTEMS LARGER THAN 3-INCH IPS. GRINNELL FIG. #199 IS ALSO ACCEPTABLE.

C. PROVIDE INSULATION PROTECTION SHIELD:
1. AT EACH HANGER FOR ALL "COLD" (LESS THAN 50 DEGREES F) PIPING SERVICES.
2. IN ACCORDANCE WITH THE FOLLOWING TABLE:
a. PIPE SIZE (IPS) SHIELD GAGE LENGTH 5" AND SMALLER1612"3. INSTALLED AS FOLLOWS:
• SURROUND LOWER COVERING.
• STRADDLE EQUIDISTANT ON HANGER.
• FLARED AT BOTH ENDS AS REQUIRED TO AVOID DAMAGE TO PIPE COVERING, JACKET AND VAPOR BARRIER.

3.6 PAINTING

A. TOUCHUP: CLEANING AND TOUCHUP OF PAINTING OF FIELD WELDS, BOLTED CONNECTIONS AND ABRADED AREAS OF SHOP PAINT ON MISCELLANEOUS METAL ARE SPECIFIED IN DIVISION 09 - FINISHES.

B. GALVANIZED SURFACES: CLEAN WELDS, BOLTED CONNECTIONS AND ABRADED AREAS. APPLY GALVANIZING REPAIR PAINT TO COMPLY WITH ASTM A780.

END OF SECTION 22 05 29

SECTION 22 05 31 - PENETRATIONS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. DRAWINGS AND GENERAL PROVISIONS OF THE CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS AND DIVISION 01 SPECIFICATION SECTIONS, APPLY TO THIS SECTION.

1.2 SUMMARY

A. THIS SECTION INCLUDES THE FURNISHING AND INSTALLATION OF THE MAJOR ITEMS LISTED BELOW:
1. PIPE SLEEVES.
2. PREFABRICATED AND SITE BUILT CURB ASSEMBLIES.
3. FLASHING AND SEALING OF ALL MECHANICAL OPENINGS THROUGH WEATHER OR WATERPROOFED WALLS, ROOFS AND FLOORS.
4. SEALING AND FINISHING OF ALL MECHANICAL OPENINGS.
5. PROVIDE UL RATED FIRESTOPPING AND SEALING AT ALL NEW AND EXISTING PIPE PENETRATIONS OF FIRE RATED WALLS.

B. DIVISION OF WORK: IN ACCORDANCE WITH THE GENERAL CONDITIONS, CONTRACTOR IS RESPONSIBLE FOR DIVIDING THE WORK AMONG THE SUBCONTRACTORS AND SUPPLIERS AND FOR DELINEATING THE WORK TO BE PERFORMED BY SPECIFIC TRADES. THE FOLLOWING ARE SUGGESTIONS AS TO HOW THE WORK MAY BE DIVIDED. THIS IS NOT A COMPLETE LIST OF ALL THE WORK:
1. GENERAL CONTRACTOR:
a. LOCATE AND PLACE ALL SLEEVED AND FRAMED OPENINGS AS PART OF CONSTRUCTING THE WALL AND FLOOR SURFACES IN WHICH THE OPENINGS OCCUR.
b. PROVIDE ALL LINTELS AND REQUIRED STIFFENING MEMBERS FOR WALL AND FLOOR OPENINGS.
c. CUT ROOFING AND INSTALL FLASHING FOR ALL REQUIRED OPENINGS IN PROPRIETARY ROOF MEMBRANE SYSTEMS.
d. CUT ALL ROOF DECK OPENINGS AND PROVIDE REQUIRED FRAMING SUPPORTS.
2. MECHANICAL SUBCONTRACTOR:
a. ADVISE GENERAL CONTRACTOR OF QUANTITY, LOCATION AND SIZE OF ALL REQUIRED OPENINGS.
b. PROVIDE ALL CURBS, SLEEVES, SEALS, ESCUTCHEONS AND RELATED MATERIALS REQUIRED FOR FINISHING, SEALING AND WATERPROOFING MECHANICAL OPENINGS. FURNISH ALL FLASHING AND COUNTERFLASHING.
c. ARRANGE AND PAY FOR ALL OPENINGS REQUIRED AFTER WALL, ROOF AND FLOOR CONSTRUCTION IS COMPLETE.

1.3 REFERENCES

A. EXCEPT AS HEREIN SPECIFIED OR AS INDICATED ON THE DRAWINGS, THE WORK OF THIS SECTION SHALL COMPLY WITH ASTM D2202 - TEST METHOD FOR SLUMP OF SEALANTS.

1.4 SUBMITTALS

A. MANUFACTURER'S LITERATURE: FOR ALL PREMANUFACTURED CURBS AND SEALING ASSEMBLIES.
1. MANUFACTURER'S NAME.
2. MODEL NUMBER.
3. DETAILS OF CONSTRUCTION AND INSTALLATION.
4. CERTIFIED LOAD-BEARING DATA FOR ALL CURBS.

1.5 QUALITY ASSURANCE

A. FABRICATION AND INSTALLATION PERSONNEL QUALIFICATIONS:
1. TRAINED AND EXPERIENCED IN THE FABRICATION AND INSTALLATION OF THE MATERIALS AND EQUIPMENT.
2. KNOWLEDGEABLE OF THE DESIGN AND THE REVIEWED SUBMITTALS.

B. CODES AND STANDARDS: "ARCHITECTURAL SHEET METAL MANUAL" AS PUBLISHED BY SMACNA.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. PREFABRICATED STACK SLEEVE ASSEMBLIES:
1. JOSAM.
2. WADE.
3. ZURN.

B. PIPE SEALS AND BOOTS:
1. THE PATE COMPANY.
2. PORTALS PLUS, INC.
3. ROOF PRODUCTS AND SYSTEMS CORPORATION.
4. THUNDERLINE CORPORATION.
5. THYCURB CORPORATION.

C. MODULAR MECHANICAL SEALS:
1. THUNDERLINE/LINK-SEAL.
2. AS APPROVED.

D. BACKER ROD: INDUSTRIAL THERMO POLYMERS, "STANDARD BACKER ROD".

E. ACOUSTICAL SEALANT: PECORA, "BA-98".

F. EXPANDING RESILIENT FOAM: GENERAL ELECTRIC, "RTF762."

2.2 MATERIALS

A. BACKER ROD:
1. EXTRUDED ROUND, CLOSED CELL, POLYETHYLENE FOAM.
2. RESILIENT, NONEXUDING.
3. DENSITY: 2.0 POUNDS PER CUBIC FOOT.
4. TENSILE STRENGTH: 50 PSI.
5. NONABSORBENT TO WATER AND GASOLINE.
6. SUITABLE FOR USE AS A BACKING FOR ACOUSTICAL [illegible].
7. COMPATIBLE WITH SEALANT AND APPROVED BY SEALANT MANUFACTURER.

B. ACOUSTICAL SEALANT:
1. NONFIRE-RATED PENETRATIONS:
a. NON-DRYING, NON-HARDENING AND NON-BLEEDING.
b. LABORATORY TESTED SEALANT WHICH EFFECTIVELY REDUCES [illegible] SOUND TRANSMISSION THROUGH WALL SYSTEMS.
c. VISCOSITY: [illegible]000 TO 400,000 (BROOKFIELD NO. 65, 10 RPM).
d. AGING: [illegible] RUBBERY, GOOD TACK AFTER 50 DAYS CONDITIONED AT 160 DEGREES F.
e. SLUMP: 0.1 TO [illegible] IN ACCORDANCE WITH ASTM D2202.
f. COLOR: GRAY.
2. [illegible]RATED PENETRATIONS: [illegible]TLY FLEXIBLE, APPROVED FIRESTOP PUTTY.

C. PACKING MATERIAL FOR PENETRATIONS:
1. [illegible] OR MINERAL FIBER:
a. [illegible]USTIBLE.
b. RESISTANT TO WATER, MILDEW, AND VERMIN.
2. EXPANDING [illegible] FOAM:
a. ACCEPTABLE [illegible] IF MANUFACTURER FOR THIS PURPOSE.
b. MINIMUM MATER[illegible]Y: 60 POUNDS PER CUBIC FOOT.

2.3 SLEEVES

A. MATERIALS:
1. 18-GAGE GALVANIZED STEEL: FOR PIPE PENETRATIONS IN NON-BEARINGS WALLS.
2. SCHEDULE 40 STEEL PIPE:
a. FOR ALL BEARING WALLS.
b. FOR ALL FLOORS.
3. CAST IRON PIPE: FOR ALL EXTERIOR BELOW GRADE INSTALLATIONS.

B. SIZE ALL SLEEVES:
1. TO ALLOW FOR MOVEMENT DUE TO EXPANSION.
2. TO PROVIDE FOR CONTINUOUS INSULATION.
3. AS INDICATED ON THE DRAWINGS.

2.4 MANUFACTURED UNITS

A. STACK SLEEVES AND FLASHING FITTINGS:
1. PROVIDE AS REQUIRED FOR ROOF AND FLOOR PIPE PENETRATIONS.
2. EQUAL TO JOSAM 264XX SERIES PRODUCTS.

B. EXTERIOR PIPE OPENING SEALS:
1. COMPATIBLE WITH INSTALLATION CONDITIONS.
2. EQUAL TO ONE OF THE FOLLOWING:
a. PATE "PIPE SEAL".
b. PORTALS PLUS MODEL C-128.
3. LINK-SEAL.

C. MODULAR MECHANICAL SEALS:
1. PROVIDE MODULAR, MECHANICAL TYPE, CONSISTING OF INTER-LOCKING SYNTHETIC RUBBER LINKS SHAPED TO CONTINUOUSLY FILL THE ANNULAR SPACE BETWEEN THE PIPE AND THE WALL OPENING.
2. THE ELASTOMERIC ELEMENT SHALL BE SIZED AND SELECTED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND HAVE THE FOLLOWING PROPERTIES AS DESIGNATED BY ASTM:
a. FOR STANDARD SERVICE APPLICATIONS:
• -40 TO +250 DEGREES F (-40 TO +121 DEGREES C).
• EPDM = ASTM D2000 M3 BA510.

PART 3 - EXECUTION

3.1 ROOF OPENINGS

A. PIPING:
1. AS INDICATED ON THE DRAWINGS.
2. FOR MULTIPLE PIPES THROUGH SINGLE OPENING:
a. SELECT SLEEVE OF AMPLE SIZE TO ACCOMMODATE PIPES.
b. PREFABRICATED INSULATED CURBS ACCEPTABLE.
3. FILL ANNULUS OPENING:
a. USE NON-COMBUSTIBLE INSULATION MATERIAL.
b. FULL DEPTH OF SLEEVE.
4. PROVIDE MOISTURE PROTECTION USING:
a. ELASTOMERIC BOOT.
b. METAL HOOD.
c. FLASHING FITTING.

B. LOCATE CURBS AND SLEEVES A MINIMUM OF 12 INCHES FROM WALLS TO PERMIT PROPER FLASHING.

3.2 INTERIOR WALL AND FLOOR OPENINGS

A. FLASH ALL FLOOR-MOUNTED DRAINS EXCEPT IN SLABS ON GRADE:
1. USE INTEGRAL FLASHING FLANGE AND CLAMP.
2. AS SPECIFIED IN DIVISION 22 SECTION "PLUMBING PIPING AND PUMPS."

B. USE RISER SLEEVE WITH INTEGRAL FLASHING FLANGE AND CLAMP FOR ALL WATERPROOF MEMBRANE FLOORS.

C. SEAL AIRTIGHT ALL OPENINGS AROUND PIPES IN THE STRUCTURE AT:
1. MECHANICAL EQUIPMENT ROOMS.
2. NOISE-CRITICAL SPACES INDICATED IN SPECIFICATIONS AND ON THE DRAWINGS. REFER TO DIVISION 22 SECTION "SOUND AND VIBRATION CONTROL FOR PLUMBING."
3. SLAB AND NOISE SENSITIVE WALL PENETRATIONS.
4. PENETRATIONS OF ALL DRYWALL CEILINGS AND CONCRETE SLABS SUSPENDED ON ISOLATORS.
5. ALL ENCLOSED SHAFT PENETRATIONS.

D. PIPE PENETRATIONS:
1. DOMESTIC WATER, SEWER, DRAIN AND VENT PIPING:
a. WHERE A PIPE PASSES THROUGH A WALL, CEILING, OR FLOOR SLAB, CAST OR GROUT A STEEL SLEEVE INTO THE STRUCTURE.
b. INTERNAL DIAMETER OF THE SLEEVE: 2 INCHES (50 MM) LARGER THAN THE EXTERNAL DIAMETER OF THE PIPE PASSING THROUGH IT.
c. AFTER ALL OF THE PIPING IS INSTALLED IN A SPECIFIC AREA, CHECK THE CLEARANCE AND CORRECT IT, IF NECESSARY, TO WITHIN 1/2-INCH (12 MM).
d. PACK THE VOID FULL DEPTH WITH PACKING MATERIAL AND SEAL AT BOTH ENDS, 1-INCH (25 MM) DEEP.
e. IN NOISE-CRITICAL WALLS AND FLOORS, PACK WITH SEALANT BACKED BY FOAM ROD.
f. WHERE PIPES PASS THROUGH A MASONRY WALL IN SUFFICIENT NUMBERS AND DENSITY THAT INDIVIDUAL PACK-AND-CALK DETAILS ARE NOT POSSIBLE, A SPECIAL ISOLATION DETAIL SHALL BE DEVELOPED:
• CAST PIPE SLEEVES IN A BLOCK OF CONCRETE WITH THE SLEEVES LOCATED A MINIMUM OF 2 INCHES (50 MM) APART.
• BLOCK THICKNESS: AT LEAST AS THICK AS THE SURROUNDING WALL CONSTRUCTION.
• EACH SLEEVE DIAMETER: 2 INCHES (50 MM) LARGER THAN THE EXTERNAL DIAMETER OF THE PIPE PASSING THROUGH IT.
• BUILD THE SLEEVED BLOCK INTO THE WALL.
• AFTER THE PIPES ARE INSTALLED, PACK AND CALK VOIDS AS INDICATED ABOVE.

3.3 OUTSIDE WALL OPENINGS

A. PIPES:
1. PASS THROUGH SLEEVES FABRICATED OF SCHEDULE 40 PIPE CUT 3/8-INCH BACK FROM FACE OF WALL ON EACH SIDE.
2. SEALED 100% WATERTIGHT.
3. PIPES BELOW GRADE USE CAST IRON SLEEVES.

3.4 FLOOR SLEEVES IN POTENTIALLY WET AREAS

A. ALL FLOORS EXCEPT SLABS ON GRADE.

B. EXTEND SLEEVES 3 INCHES ABOVE FINISHED FLOOR.

C. PROVIDE POURED CONCRETE CURB FOR DUCT OPENINGS AS INDICATED IN THE DRAWINGS.

3.5 ESCUTCHEONS AND CLOSURE COLLARS

A. INCLUDES CEILINGS, PARTITIONS, FLOOR AND WALLS.

B. PROVIDE ESCUTCHEONS FOR ALL PIPING:
1. SIZED TO FIT OVER COVERINGS.
2. IN ALL POTENTIALLY WET AREAS: STAINLESS STEEL IN FOOD PROCESSING AREAS.
3. IN ALL DRY FINISHED AREAS: CHROME PLATED.
4. DO NOT USE ESCUTCHEONS IN ACOUSTIC ISOLATION WALLS UNLESS OTHERWISE INDICATED.

END OF SECTION 22 05 31

SECTION 22 05 48 - SOUND AND VIBRATION CONTROL FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. DRAWINGS AND GENERAL PROVISIONS OF THE CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS AND DIVISION 01 SPECIFICATION SECTIONS, APPLY TO THIS SECTION.

1.2 SUMMARY

A. THIS SECTION INCLUDES THE FURNISHING AND INSTALLATION OF ALL EQUIPMENT FOR AND RELATED ITEMS INCIDENTAL TO ISOLATION AND ATTENUATION OF VIBRATION AND SOUND CONTROL OF PLUMBING SYSTEMS:
1. MAJOR ITEMS:
a. ISOLATE ROTATING OR VIBRATING EQUIPMENT WITH VIBRATION ISOLATORS.
b. CONNECT PIPING TO EQUIPMENT BY MEANS OF FLEXIBLE CONNECTIONS.
c. INSTALL EQUIPMENT AND PIPING ON, OR SUSPENDED FROM, APPROVED AND SPECIFIED FOUNDATIONS OR SUPPORTS.
2. ALL VIBRATION ISOLATION DEVICES SHALL BE FURNISHED BY A SINGLE MANUFACTURER.

B. DIVISION OF WORK: IN ACCORDANCE WITH THE GENERAL CONDITIONS, CONTRACTOR IS RESPONSIBLE FOR DIVIDING THE WORK AMONG THE SUBCONTRACTORS AND SUPPLIERS AND FOR DELINEATING THE WORK TO BE PERFORMED BY SPECIFIC TRADES. THE FOLLOWING ARE SUGGESTIONS AS TO HOW THE WORK MAY BE DIVIDED. THIS IS NOT A COMPLETE LIST OF ALL THE WORK:
1. GENERAL CONTRACTOR: PROVIDE CONCRETE EQUIPMENT PADS.
2. PLUMBING SUBCONTRACTOR:
a. PROVIDE MISCELLANEOUS STRUCTURAL STEEL NECESSARY FOR SUPPORT OF MECHANICAL WORK.
b. COORDINATE NECESSARY ALTERATIONS IN STRUCTURAL STEEL.

1.3 REFERENCES

A. EXCEPT AS HEREIN SPECIFIED OR AS INDICATED ON THE DRAWINGS, THE WORK OF THIS SECTION SHALL COMPLY WITH THE FOLLOWING:
1. ASHRAE - 2011 HVAC APPLICATION HANDBOOK - TABLE 47 OF CHAPTER [illegible] SELECTION GUIDE FOR VIBRATION ISOLATION".
2. ASTM:
a. C665 - SPECIFICATION FOR MINERAL FIBER BLANKET THERMAL INSULATION.
b. E84 - TEST METHOD FOR SURFACE BURNING CHARACTERISTICS OF BUILDING MATERIALS.
c. E90 - TEST METHOD FOR LABORATORY MEASUREMENT OF AIRBORNE SOUND TRANSMISSION LOSS OF BUILDING PARTITIONS.
d. G21 - PRACTICE FOR DETERMINING RESISTANCE OF SYNTHETIC POLYMERIC MATERIALS TO FUNGI.
e. G22 - PRACTICE FOR DETERMINING RESISTANCE OF PLASTICS TO BACTERIA.
3. NFPA STANDARD: 255 - SURFACE BURNING CHARACTERISTICS OF BUILDING MATERIALS.

1.4 DESIGN AND PERFORMANCE REQUIREMENTS

A. THE ISOLATION MATERIALS MANUFACTURER SHALL BE RESPONSIBLE FOR THE PROPER SELECTION OF ISOLATORS TO ACHIEVE THE SPECIFIED MINIMUM STATIC DEFLECTIONS, FOR ALL ISOLATORS BASED ON THE ACTUAL WEIGHT DISTRIBUTION OF EQUIPMENT TO BE ISOLATED.

B. THE ISOLATION MATERIALS MANUFACTURER SHALL BE RESPONSIBLE FOR THE STRUCTURAL DESIGN OF STEEL BEAM BASES AND CONCRETE INERTIA BASES, TO SUIT EQUIPMENT SCHEDULED TO RECEIVE SUCH SUPPLEMENTARY BASES.

C. BE RESPONSIBLE FOR VERIFYING THE COMPLETENESS OF THE ISOLATION INSTALLATION AND THE OVERALL SUITABILITY OF THE EQUIPMENT TO MEET THE INTENT OF THIS SPECIFICATION. ANY ADDITIONAL EQUIPMENT NEEDED TO MEET THE INTENT OF THE SPECIFICATION, EVEN IF NOT SPECIFICALLY MENTIONED HEREIN OR IN THE CONTRACT DOCUMENTS, SHALL BE SUPPLIED BY THE CONTRACTOR WITHOUT CLAIM FOR ADDITIONAL PAYMENT.

D. SEALED PENETRATIONS: DESIGNATED BUILDING STRUCTURES DESIGNED TO ISOLATE AIR-BORNE NOISE SURROUNDING ALL CRITICAL AND NOISY SPACES. PROPER ROUTING OF AND SEALING OR LAGGING (ENCLOSURE), OR BOTH, ALL PLUMBING SERVICES PENETRATING THESE STRUCTURES ARE NECESSARY TO MAINTAIN THE INTEGRITY OF THE ISOLATION STRUCTURE.

E. STRUCTURAL ISOLATION: SEPARATIONS OF BUILDING STRUCTURES ALONG ACOUSTICAL JOINTS HAVE BEEN DESIGNED TO REDUCE STRUCTURAL TRANSMISSION OF SOUND INTO CRITICAL SPACES. PLUMBING AND ELECTRICAL SERVICES MUST AVOID RIGIDLY BRIDGING ACROSS TWO STRUCTURES ISOLATED FROM EACH OTHER.

1.5 NOISE CRITICAL SPACES

A. MANY AREAS OF THIS BUILDING REQUIRE SPECIAL ATTENTION (SPECIAL ACOUSTICAL PROVISIONS AND RESTRICTIONS) TO ALLOWED BACKGROUND NOISE LEVELS. THE FOLLOWING AREAS ARE DESIGNATED AS "NOISE-CRITICAL" SPACES:
1. ALL AUDITORIUMS.

B. NOISE-CRITICAL WALLS ARE ALL WALLS ENCLOSING THE ABOVE SPACES, AND INCLUDE SPACES THAT CONTAIN NOISE PRODUCING EQUIPMENT IN ADDITION TO THE "NOISE-CRITICAL" SPACES LISTED ABOVE. NOISE-CRITICAL SLABS ARE THOSE SLABS (AND ALL ASSOCIATED ISOLATED CEILINGS OR FLOATING FLOOR SLABS) THAT ARE ABOVE AND BELOW ROOMS ENCLOSED BY NOISE CRITICAL WALLS.

C. PENETRATIONS OF NOISE CRITICAL WALLS AND SLABS BY PIPES AND CONDUIT SHALL BE SLEEVED, PACKED, AND SEALED AIRTIGHT WITH NON-HARDENING SEALANT AS DESCRIBED IN DIVISION 22 SECTION "PENETRATIONS FOR PLUMBING."

1.6 SUBMITTALS

A. MANUFACTURER'S LITERATURE: FOR ALL PRODUCTS DESCRIBED UNDER PART 2 OF THESE SPECIFICATIONS.
1. GENERAL:
a. DIMENSIONS.
b. CONSTRUCTION DETAILS.
c. MANUFACTURER'S NAME.
d. MODEL NUMBER.
2. SPRING ISOLATORS:
a. RATED DEFLECTION.
b. SPRING CONSTANT.
c. MODEL NUMBER.
d. TYPE OF ISOLATOR.
e. SIZE.
f. HEIGHT WHEN UNCOMPRESSED AND MAXIMUM ALLOWED STATIC DEFLECTION.
g. ISOLATOR LOCATION SHOWN ON AN OUTLINE OF THE ISOLATED EQUIPMENT.
h. DETAIL DRAWINGS OF INERTIA BASES ISOLATORS.
i. LOCATION OF ISOLATORS ON PLAN DRAWINGS OF THE ISOLATED AREA, WHERE APPLICABLE.
j. THE WEIGHT OF ALL ISOLATED EQUIPMENT, AND THE LOADS ON EACH ISOLATOR AND THE STATIC DEFLECTION OF EACH ISOLATOR UNDER THE SPECIFIC DESIGN LOAD SHALL BE LISTED ALONG WITH THE PROPOSED ISOLATORS.
k. PIPE ISOLATORS SHALL BE SHOWN AND IDENTIFIED ON PIPING LAYOUT DRAWINGS.

B. FURNISH A COMPLETE SET OF APPROVED SHOP DRAWINGS OF ALL PLUMBING EQUIPMENT TO RECEIVE VIBRATION ISOLATION DEVICES TO THE VIBRATION ISOLATION MATERIALS MANUFACTURER, BASED UPON THE SELECTION OF VIBRATION ISOLATORS AND DESIGN OF SUPPLEMENTARY BASES WILL BE COMPLETED. THE SHOP DRAWINGS TO BE FURNISHED SHALL INCLUDE OPERATING WEIGHTS OF THE EQUIPMENT TO BE ISOLATED AND THE DISTRIBUTION OF WEIGHT AT SUPPORT POINTS.

1.7 QUALITY ASSURANCE

A. FABRICATION AND INSTALLATION PERSONNEL QUALIFICATIONS:
1. TRAINED AND EXPERIENCED IN THE FABRICATION AND INSTALLATION OF THE MATERIALS AND EQUIPMENT.
2. KNOWLEDGEABLE OF THE DESIGN AND THE REVIEWED SHOP DRAWINGS.

B. MANUFACTURER OR QUALIFIED REPRESENTATIVE SERVICES:
1. PROVIDE NECESSARY FIELD SUPERVISION.
2. ENSURE CORRECT INSTALLATION AND ADJUSTMENT.

C. REGULATORY AGENCIES REQUIREMENTS:
1. COMPLY WITH ALL STATE AND LOCAL CODES AND ORDINANCES.
2. INSULATION, FACING, AND ADHESIVE SHALL HAVE A COMPOSITE RATING:
a. 25 FLAME SPREAD MAXIMUM.
b. 50 SMOKE DEVELOPED MAXIMUM.
c. IN ACCORDANCE WITH NFPA 255.
3. INSTALLATION OF ACOUSTIC DUCT LINER SHALL BE IN ACCORDANCE WITH:
a. SMACNA - HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE:
• ACOUSTICAL LINER INSTALLATION STANDARDS.
• MECHANICAL FASTENER STANDARD.
b. NAIMA - FIBROUS GLASS DUCT LINER STANDARDS.

1.8 DELIVERY, STORAGE, AND HANDLING

A. ALL MATERIALS SHALL BE DELIVERED IN ORIGINAL, UNBROKEN, BRAND MARKED CONTAINERS OR WRAPPINGS AS APPLICABLE.

B. HANDLE AND STORE MATERIALS IN A MANNER WHICH WILL PREVENT DETERIORATION OR DAMAGE, CONTAMINATION WITH FOREIGN MATTER, DAMAGE BY WEATHER OR ELEMENTS, AND IN ACCORDANCE WITH MANUFACTURER'S DIRECTIONS.

C. REJECT DAMAGED, DETERIORATED, OR CONTAMINATED MATERIAL AND IMMEDIATELY REMOVE FROM THE SITE. REPLACE REJECTED MATERIALS WITH NEW MATERIALS AT NO ADDITIONAL COST TO OWNER.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. VIBRATION CONTROL: ALL VIBRATION CONTROL APPARATUS SHALL BE PROVIDED BY A SINGLE MANUFACTURER EXCEPT AS SPECIFICALLY NOTED HEREIN:
1. AMBER-BOOTH.
2. MASON INDUSTRIES, INC.
3. VIBRON.
4. KINETICS.

2.2 VIBRATION ISOLATION EQUIPMENT

A. ISOLATION PADS:
1. ISOLATOR TYPE WP:
a. TYPE WP (WAFFLE PADS) SHALL BE 5/16-INCH (8 MM) THICK NEOPRENE PADS, RIBBED OR WAFFLED ON BOTH SIDES. THE PADS SHALL BE SELECTED FOR 15% STRAIN. WHERE REQUIRED, STEEL LOAD-SPREADING PLATES SHALL BE INCORPORATED BETWEEN THE EQUIPMENT AND THE NEOPRENE PAD. NEOPRENE SHALL BE BRIDGE-BEARING QUALITY WITH A MAXIMUM DUROMETER (SHORE A SCALE) OF 50.
b. IF THE ISOLATOR IS BOLTED TO THE STRUCTURE, A NEOPRENE VIBRATION ISOLATION WASHER AND SLEEVE (UNIROYAL TYPE 620/660 OR AS APPROVED) SHALL BE INSTALLED UNDER THE BOLT HEAD BETWEEN THE STEEL WASHER AND THE BASE PLATE.
c. TYPE WP: MASON INDUSTRIES TYPE W; OR AS APPROVED BY ENGINEER.
2. ISOLATOR TYPE MWP:
a. TYPE MWP (METAL AND WAFFLE SANDWICH PADS) SHALL CONSIST OF TWO 5/16-INCH (8 MM) THICK RIBBED OR WAFFLE NEOPRENE PADS SANDWICHING A 16 GAGE STAINLESS OR GALVANIZED STEEL SHIM PLATE. THE PAD SHALL BE DESIGNED FOR 15% STRAIN. NEOPRENE SHALL BE BRIDGE-BEARING QUALITY WITH A MAXIMUM DUROMETER (SHORE A SCALE) OF 50.
b. IF THE ISOLATOR IS BOLTED TO THE STRUCTURE, A NEOPRENE VIBRATION ISOLATION WASHER AND SLEEVE (UNIROYAL TYPE 620/660, OR AS APPROVED) SHALL BE INSTALLED UNDER THE BOLT HEAD BETWEEN THE STEEL WASHER AND THE BASE PLATE.
c. TYPE MWP: MASON INDUSTRIES TYPE WSW; OR AS APPROVED BY ENGINEER.
3. ISOLATOR TYPE DDNM:
a. TYPE DDNM (DOUBLE DEFLECTION NEOPRENE MOUNTS) SHALL BE LATERALLY STABLE, DOUBLE DEFLECTING, MOLDED NEOPRENE ISOLATORS. ALL METAL SURFACES SHALL BE COVERED WITH NEOPRENE. THE TOP AND BOTTOM SURFACES SHALL BE RIBBED AND BOLT HOLES SHALL BE PROVIDED IN THE BASE. THE MOUNTS SHALL HAVE LEVELING BOLTS RIGIDLY SECURED TO THE EQUIPMENT.
b. THE STRAIN ON THE NEOPRENE SHALL NOT EXCEED 15%. DDNM MOUNTS SHALL BE SELECTED FOR A STATIC DEFLECTION OF 3/8-INCH (9 MM) UNLESS OTHERWISE SPECIFIED. NEOPRENE SHALL BE BRIDGE-BEARING QUALITY WITH A MAXIMUM DUROMETER (SHORE A SCALE) OF 60.
c. TYPE DDNM: MASON INDUSTRIES TYPE ND; OR AS APPROVED BY ENGINEER.
4. ISOLATOR TYPE RBA:
a. TYPE RBA ISOLATORS SHALL BE DESIGNED WITH A NEOPRENE ELEMENT TO PROVIDE ISOLATION IN TENSION, SHEAR OR COMPRESSION. NEOPRENE SHALL BE BRIDGE-BEARING QUALITY WITH A MAXIMUM DUROMETER OF 50.
b. TYPE RBA: MASON INDUSTRIES TYPE RBA; OR AS APPROVED BY ENGINEER.

B. ISOLATION HANGERS:
1. ISOLATOR TYPE DDNH:
a. TYPE DDNH (DOUBLE DEFLECTION NEOPRENE HANGERS) SHALL CONSIST OF A MOLDED NEOPRENE ISOLATING ELEMENT IN A STEEL HANGER BOX. A NEOPRENE GROMMET EXTENDING FROM AND CONTIGUOUS WITH THE MAIN NEOPRENE ELEMENT SHALL BE PROVIDED WHERE THE LOWER HANGER ROD PASSES THROUGH THE STEEL HANGER BOX, SUCH THAT THE HANGER ROD CANNOT CONTACT THE STEEL HANGER BOX. THE DIAMETER OF THE CLEAR HOLE IN THE HANGER BOX SHALL BE AT LEAST 3/4-INCH (19 MM) LARGER THAN THE DIAMETER OF THE HANGER ROD AND PERMIT THE HANGER ROD TO SWING THROUGH A 30-DEGREE ARC. WHEN INSTALLED, THE HANGER BOX SHALL BE ALLOWED TO ROTATE THROUGH A FULL 360 DEGREES WITHOUT ENCOUNTERING ANY OBSTRUCTIONS.
b. UNLESS OTHERWISE SPECIFIED, THE STATIC DEFLECTION OF DDNH HANGERS SHALL BE 0.3 INCHES (8 MM) WITH A STRAIN NOT EXCEEDING 15%. NEOPRENE SHALL BE BRIDGE-BEARING QUALITY WITH A MAXIMUM DUROMETER (SHORE A SCALE) OF 60.
c. TYPE DDNH: MASON INDUSTRIES TYPE HD; OR AS APPROVED BY ENGINEER.

C. SPRING ISOLATORS:
1. ISOLATOR TYPE SFNM:
a. TYPE SFNM (SPRING AND NEOPRENE MOUNTS) SHALL HAVE A FREE-STANDING AND LATERALLY STABLE STEEL SPRING WITHOUT ANY HOUSING. SPRINGS SHALL BE DESIGNED SO THAT THE RATIO OF THE HORIZONTAL TO VERTICAL SPRING CONSTANT IS BETWEEN 1 AND 2. THE SPRING DIAMETER SHALL BE NOT LESS THAN 80% OF THE COMPRESSED HEIGHT OF THE SPRING AT RATED LOAD. LOADED SPRINGS SHALL HAVE A MINIMUM ADDITIONAL TRAVEL TO SOLID EQUAL TO 50% OF THE SPECIFIED STATIC DEFLECTION. UNLESS OTHERWISE SPECIFIED, THE MINIMUM STATIC DEFLECTION OF SFNM ISOLATORS FOR EQUIPMENT MOUNTED ON GRADE SLABS SHALL BE 1 INCH (25 MM), AND THE MINIMUM STATIC DEFLECTION FOR EQUIPMENT MOUNTED ABOVE THE LOWEST LEVEL (I.E. ABOVE A GRADE SLAB) SHALL BE 2 INCHES (50 MM).
b. TYPE WP ISOLATION PADS SANDWICHING A 16 GAGE STAINLESS OR GALVANIZED STEEL SEPARATOR PLATE SHALL BE BONDED TO THE ISOLATOR BASEPLATE.
c. UNLESS OTHERWISE SPECIFIED, ISOLATORS NEED NOT BE BOLTED TO THE FLOOR FOR INDOOR INSTALLATIONS. IF THE BASE PLATES ARE BOLTED TO THE STRUCTURE, A NEOPRENE VIBRATION ISOLATION WASHER AND SLEEVE (UNIROYAL TYPE 620/660; OR AS APPROVED) SHALL BE INSTALLED UNDER THE BOLT HEAD BETWEEN THE STEEL WASHER AND THE BASE PLATE.
d. TYPE SFNM: MASON INDUSTRIES TYPE SLFSW; OR AS APPROVED BY ENGINEER.
2. ISOLATOR TYPE SPNH:
a. TYPE SPNH (SPRING AND NEOPRENE HANGERS) SHALL CONSIST OF A STEEL SPRING IN SERIES WITH A NEOPRENE ISOLATING ELEMENT. THE SPRING SHALL HAVE A MINIMUM ADDITIONAL TRAVEL TO SOLID EQUAL TO 50% OF THE SPECIFIED DEFLECTION. THE NEOPRENE ELEMENT SHALL HAVE A STATIC DEFLECTION OF NOT LESS THAN 0.3 INCHES (8 MM) WITH A STRAIN NOT EXCEEDING 15%.
b. UNLESS OTHERWISE SPECIFIED, THE STATIC DEFLECTION OF SPNH HANGERS SHALL BE 2 INCHES (50 MM). NEOPRENE SHALL BE BRIDGE-BEARING QUALITY WITH A MAXIMUM DUROMETER OF 60.
c. SPRING DIAMETER AND HANGER BOX HOLE SIZE SHALL BE LARGE ENOUGH TO PERMIT THE HANGER ROD TO SWING THROUGH A 30 DEGREE ARC. A NEOPRENE GROMMET EXTENDING FROM AND CONTIGUOUS WITH THE MAIN NEOPRENE ELEMENT SHALL BE PROVIDED WHERE THE HANGER ROD PASSES THROUGH THE STEEL HANGER BOX, SUCH THAT THE HANGER ROD CANNOT CONTACT THE STEEL HANGER BOX. THE DIAMETER OF THE CLEAR HOLE IN THE HANGER BOX SHALL BE AT LEAST 3/4-INCH (19 MM) LARGER THAN THE DIAMETER OF THE HANGER ROD. WHEN INSTALLED, THE SPRING ELEMENT SHALL NOT BE COCKED, AND THE HANGER BOX SHALL BE ALLOWED TO ROTATE THROUGH A FULL 360 DEGREE ARC WITHOUT ENCOUNTERING ANY OBSTRUCTIONS.
d. TYPE SPNH: MASON INDUSTRIES TYPE 30N; OR AS APPROVED BY ENGINEER.
3. ISOLATOR TYPE CSNM:
a. TYPE CSNM (CONSTRAINED SPRING AND NEOPRENE MOUNTS) SHALL BE A SPRING AND NEOPRENE MOUNT THAT INCORPORATES A HOUSING WHICH INCLUDES VERTICAL LIMIT STOPS TO PREVENT SPRING EXPANSION WHEN WEIGHT (WATER OR OTHER FLUID) IS REMOVED FROM THE EQUIPMENT AND LIMITS THE MOVEMENT OF EQUIPMENT WHEN IT IS SUBJECTED TO WIND LOADING. A MINIMUM CLEARANCE OF 1-INCH (25 MM) SHALL BE MAINTAINED AROUND RESTRAINING BOLTS AND BETWEEN THE HOUSING AND THE SPRING, SO AS NOT TO INTERFERE WITH THE SPRING OPERATION. LIMIT STOPS SHALL BE OUT OF CONTACT DURING NORMAL OPERATION, BACKED AWAY FROM CONTACT BY AT LEAST 1/2-INCH (12 MM). A NEOPRENE WASHER SHALL BE INSTALLED BENEATH THE BOLT HEAD/WASHER USED TO RESTRAIN THE ISOLATOR. IN OUTDOOR ROOFTOP INSTALLATIONS ISOLATORS MUST BE BOLTED TO THE ROOF OR SUPPORTING STRUCTURE WITH A NEOPRENE MOUNTING SLEEVE.
b. UNLESS OTHERWISE SPECIFIED, THE MINIMUM STATIC DEFLECTION FOR TYPE CSNM MOUNTS SHALL BE 2 INCHES (50 MM).
c. TYPE CSNM: MASON INDUSTRIES TYPE SLR; OR AS PRE-APPROVED BY ENGINEER.

D. NEOPRENE MOUNTING SLEEVES: NEOPRENE MOUNTING SLEEVES FOR HOLD-DOWN APPLICATIONS OF EQUIPMENT WITH VIBRATION ISOLATORS SHALL BE UNIROYAL TYPE 620/660.

E. PIPE FLEXIBLE CONNECTORS:
1. ISOLATOR TYPE PFC (PIPE FLEXIBLE CONNECTORS) SHALL BE KEVLAR-REINFORCED NEOPRENE, SINGLE OR DOUBLE-SPHERE DESIGN. FLEXIBLE CONNECTORS WITH CONTROL RODS WILL NOT BE PERMITTED.
2. TYPE PFC: MASON INDUSTRIES "SAFEFLEX" TYPE SFEJ OR SFDEJ.

F. RISER GUIDE FOR ISOLATED PIPEWORK: RISER GUIDES FOR ISOLATED PIPES SHALL BE TYPE DDNM ISOLATORS BOLTED TO THE VERTICAL EDGE OF A 90 DEGREE STEEL ANGLE. THE GUIDE SHALL ALLOW THE PIPE TO MOVE AXIALLY, BUT SHALL LIMIT LATERAL MOVEMENT TO APPROXIMATELY 1-INCH (25 MM).

PART 3 - EXECUTION

3.1 GENERAL

A. UNLESS OTHERWISE INDICATED, ALL EQUIPMENT MOUNTED ON VIBRATION ISOLATORS SHALL HAVE A MINIMUM OPERATING CLEARANCE OF 2 INCHES (50 MM) BETWEEN THE BOTTOM OF THE EQUIPMENT OR INERTIA BASE (AND HEIGHT-SAVING BRACKET) AND THE CONCRETE HOUSEKEEPING PAD (OR BOLT HEADS, WHICHEVER IS CLOSEST) BENEATH THE EQUIPMENT. THE CLEARANCE SHALL BE CHECKED TO ENSURE THAT NO SCRAPS HAVE BEEN LEFT TO SHORT-CIRCUIT THE VIBRATION ISOLATORS. THERE SHALL BE A MINIMUM 4-INCH (100 MM) CLEARANCE BETWEEN ISOLATED EQUIPMENT AND THE WALLS, CEILING, FLOORS, COLUMNS, AND ANY OTHER EQUIPMENT NOT INSTALLED ON VIBRATION ISOLATORS.

B. PIPING, CONDUIT OR PLUMBING EQUIPMENT SHALL NOT BE HUNG FROM OR SUPPORTED ON OTHER EQUIPMENT, PIPES, OR DUCTWORK INSTALLED ON VIBRATION ISOLATORS. IT SHALL BE SUPPORTED ON OR SUSPENDED FROM BUILDING STRUCTURE.

C. EQUIPMENT CONNECTED TO FLUID PIPING SHALL BE ERECTED ON ISOLATORS OR ISOLATED FOUNDATIONS AT CORRECT OPERATING HEIGHTS PRIOR TO CONNECTION OF PIPING. EQUIPMENT SHOULD BE BLOCKED-UP WITH TEMPORARY SHIMS TO FINAL OPERATING HEIGHT. WHEN THE SYSTEM IS ASSEMBLED AND FLUID IS ADDED, THE ISOLATORS SHALL BE ADJUSTED TO ALLOW REMOVAL OF THE SHIMS, AND CONFIRM THAT THE ISOLATORS FOR THE FLUID-FILLED PIPES, PUMPS, AND OTHER ELEMENTS DEFLECT THE SPECIFIED AMOUNTS AND NO MORE.

D. ALL PLUMBING EQUIPMENT NOT SPECIFICALLY IDENTIFIED IN THIS SPECIFICATION THAT CONTAINS ROTATING OR VIBRATING ELEMENTS, AND ALL ASSOCIATED ELECTRICAL APPARATUS INSTALLED BY THIS DIVISION THAT CONTAINS TRANSFORMERS OR INDUCTORS SHALL BE INSTALLED ON TYPE DDNM OR RBA NEOPRENE ISOLATORS AS APPROPRIATE. IN ALL SUCH INSTANCES, SUBMIT THE PROPOSED ISOLATORS WITH THE ISOLATOR SHOP DRAWINGS.

E. ALL ISOLATORS THAT ARE TO BE INSTALLED OUTDOORS OR EXPOSED TO THE WEATHER SHALL BE HOT-DIPPED GALVANIZED AND SHALL BE FURNISHED WITH NEOPRENE MOUNTING SLEEVES FOR HOLD-DOWN BOLTS TO PREVENT ANY METAL-TO-METAL CONTACT.

F. ELASTOMERIC ISOLATORS THAT WILL BE EXPOSED TO TEMPERATURES BELOW 32 DEGREES F (0 DEGREES C), SHALL BE FABRICATED FROM NATURAL RUBBER INSTEAD OF NEOPRENE.

G. WIRING:
1. ALL WIRING CONNECTIONS TO MECHANICAL EQUIPMENT ON VIBRATION ISOLATORS (EITHER SPRING OR NEOPRENE TYPE) SHALL BE MADE WITH A MINIMUM 36-INCH (1 M) LONG FLEXIBLE CONDUIT IN A 360-DEGREE LOOP.
2. ALL TIES USED TO FORM THE LOOP SHALL BE REMOVED PRIOR TO ADJUSTING THE ISOLATORS.

3.2 PIPE ISOLATION

A. PIPES CONNECTED TO EQUIPMENT ON SPRING ISOLATORS:
1. ALL PIPES CONNECTED TO EQUIPMENT INSTALLED ON SPRING VIBRATION ISOLATORS SHALL BE SUSPENDED, SUPPORTED, AND GUIDED BY MEANS OF APPROPRIATE SPRING VIBRATION ISOLATORS AS DESCRIBED BELOW. THIS INCLUDES, BUT IS NOT NECESSARILY LIMITED TO DOMESTIC WATER PIPES. THE ONLY EXCLUSIONS ARE ROOF AND FLOOR DRAIN AND SPRINKLER PIPING. PIPES SHALL BE SUPPORTED BY TYPE SPNH ISOLATORS OR HUNG FROM THE STRUCTURE ON TYPE SPNH ISOLATORS.
2. THE FIRST ISOLATOR BOTH UPSTREAM AND DOWNSTREAM OF EQUIPMENT ON SPRINGS SHALL HAVE A STATIC DEFLECTION EQUAL TO 1.5 TIMES THAT OF THE EQUIPMENT ISOLATORS, UP TO A MAXIMUM OF 2 INCHES (50 MM). THE STATIC DEFLECTION OF THE REMAINING PIPE ISOLATORS SHALL BE 1-INCH (25 MM).

B. PIPES CONNECTED TO EQUIPMENT ON NEOPRENE ISOLATORS: PIPING THAT IS CONNECTED ONLY TO MACHINERY INSTALLED ON NEOPRENE ISOLATORS SHALL BE EITHER SUPPORTED FROM THE FLOOR ON TYPE DDNM MOUNTS OR SUSPENDED FROM THE STRUCTURE ON TYPE DDNH HANGERS.

C. PIPES WITH MULTIPLE CONNECTIONS: WHERE A PIPE RUN CONNECTS MULTIPLE ITEMS OF EQUIPMENT IN THE MECHANICAL ROOM, THE PIPE ISOLATORS FOR THE ENTIRE RUN SHALL BE CHOSEN TO SUIT THE CONNECTED EQUIPMENT OF GREATEST STATIC DEFLECTION.

D. A FLEXIBLE CONNECTOR SHALL BE INSTALLED TO CONNECT A PIPE ON ISOLATORS TO A PIECE OF EQUIPMENT ON ISOLATORS OF LESS STATIC DEFLECTION THAN THE PIPE.

3.3 PIPE ISOLATION OUTSIDE THE MECHANICAL ROOM

A. LARGE SANITARY SEWER AND DOMESTIC WATER PIPES:
1. EXCEPT AS NOTED HEREIN, NOTABLY AT STRUCTURAL JOINTS, ALL PIPES OUTSIDE THE MECHANICAL ROOM WITH A DIAMETER GREATER THAN 2 INCHES (50 MM) INCLUDING DOMESTIC WATER AND SANITARY SEWER PIPES; EXCLUDING ROOF/FLOOR DRAIN PIPES AND VENT PIPES SHALL BE SUPPORTED ON TYPE SPNH ISOLATORS OR SUSPENDED ON TYPE SPNH ISOLATORS.
2. WHERE PIPES ARE GANGED ON A TRAPEZE, THE PIPES SHALL REST ON THE TRAPEZE AND THE TRAPEZE SHALL BE ISOLATED FROM THE STRUCTURE WITH THE APPROPRIATE ISOLATORS; NEOPRENE PIPE RISER GUIDES SHALL BE USED WHERE LATERAL RESTRAINT IS REQUIRED.
3. IN A VERTICAL CHASE, THE PIPE SHALL BE SUPPORTED ON SPRING AND NEOPRENE ISOLATORS; IF LATERAL RESTRAINT IS REQUIRED, USE NEOPRENE RISER GUIDES TO LIMIT LATERAL MOVEMENT AND TO PREVENT SOLID CONTACT TO SUPPORTING STRUCTURE.

B. DRAIN PIPES, VENT PIPES, AND SMALL DOMESTIC WATER PIPES:
1. EXCEPT AS NOTED, OUTSIDE THE MECHANICAL ROOM, ALL DOMESTIC HOT AND COLD WATER PIPES WITH A DIAMETER LESS THAN OR EQUAL TO 2 INCHES (50 MM), SHALL BE LOCATED ON DDNM AND DDNH ISOLATORS.
2. ALL DRAIN PIPES AND VENT PIPES ON ISOLATED BUILDING STRUCTURE SHALL BE SUPPORTED ON DDNM OR DDNH ISOLATORS. ALL DRAIN PIPES AND VENT PIPES NOT ON ISOLATED STRUCTURE SHALL BE ISOLATED FROM THE STRUCTURE WITH SPONGE NEOPRENE, FELT OR GLASS/MINERAL FIBER SLEEVES BETWEEN THE PIPE AND PIPE CLAMP, OR WITH TYPE WP PADS BETWEEN THE CLAMP AND THE STRUCTURE.
3. WHEN IT IS COMPRESSED, THE SLEEVE SHALL BE NOT LESS THAN 1/8-INCH (3 MM) IN THICKNESS. THIS PROVISION SHALL APPLY TO ALL PIPING NOT OTHERWISE REQUIRED TO BE INSTALLED ON VIBRATION ISOLATORS. NOTE THAT INLINE DOMESTIC WATER PUMPS AND THE SURROUNDING PIPING SHALL BE INSTALLED ON ISOLATORS AS DESCRIBED ABOVE. NOTE THAT PIPES CROSSING STRUCTURAL JOINTS SHALL BE ISOLATED AS DESCRIBED ABOVE.

C. PIPE RISERS: WHERE PIPES RISE IN A VERTICAL CHASE, ARE SUPPORTED FROM A STRUCTURE WITH TYPE SPNH OR DDNH ISOLATORS, AND REQUIRE LATERAL BRACING, NEOPRENE RISER GUIDES SHALL BE MOUNTED AROUND THE PIPE TO LIMIT LATERAL MOVEMENT AND TO PREVENT DIRECT CONTACT WITH THE SUPPORTING STRUCTURE.

D. PIPES CROSSING ACOUSTIC JOINTS:
1. ALL PIPE CROSSING A BUILDING ACOUSTIC JOINT SHALL HAVE A TWIN-SPHERE NEOPRENE FLEXIBLE CONNECTOR AT THE JOINT, WITH THE EXCEPTION OF PIPING ASSOCIATED WITH FIRE PROTECTION, GAS AND COMPRESSED AIR, AND SHALL BE SUSPENDED BY TYPE SPNH ISOLATORS AS FOLLOWS:
a. PIPES WITH AN INNER DIAMETER LESS THAN 2 INCHES (50 MM) SHALL BE SUSPENDED BY SPNH ISOLATORS FOR A MINIMUM DISTANCE OF AT LEAST 30 FEET (10 M) ON EACH SIDE OF THE JOINT.
b. PIPES WITH AN INNER DIAMETER OF 2 INCHES (50 MM) AND GREATER SHALL BE SUSPENDED ON TYPE SPNH ISOLATORS FOR A MINIMUM DISTANCE OF AT LEAST 30 FEET (10 M) ON THE NON-ISOLATED STRUCTURE AND FOR THE ENTIRE PIPE LENGTH ON THE ISOLATED STRUCTURE.
2. ALL DRAIN, VENT, GAS, OR COMPRESSED AIR PIPE CROSSING AN ACOUSTIC JOINT SHALL BE SUPPORTED WITH TYPE DDNH OR DDNM NEOPRENE ISOLATORS FOR AT LEAST 30 FEET (10 M) ON EACH SIDE OF THE JOINT.

3.4 MISCELLANEOUS EQUIPMENT

A. ICE MAKERS, BEVERAGE COMPRESSORS, AND REFRIGERATION UNITS: INSTALLERS OF FOOD SERVICE EQUIPMENT SHALL INSTALL EQUIPMENT ON APPROPRIATE VIBRATION ISOLATORS, TO BE DETERMINED BY THE ACOUSTICS SUPPLIER; AND APPROVED BY ENGINEER.

3.5 FIELD QUALITY

A. WORK IN ACCORD WITH BEST TRADE PRACTICES, FABRICATE AND INSTALL ALL ITEMS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND ENGINEER'S DIRECTIONS, AND CONSULT WITH TRADES DOING ADJOINING WORK IN ORDER TO PROVIDE AN INSTALLATION OF FIRST CLASS [illegible].

CONTINUED ON SHEET P704

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