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TECHNICAL SPECIFICATION

SAFETY RELATED HVAC SYSTEM DUCTWORK

KRSKO NUCLEAR POWER PLANT
KRSKO, YUGOSLAVIA
SP-B507-044687-000 NOVEMBER 21, 1975

REVISION 1 May 14, 1976
REVISION 2 SEPTEMBER 29, 1977

SAFETY RELATED

PREPARED FOR

WESTINGHOUSE POWER SYSTEMS PROJECTS DIVISION

Prepared by O. A. Favio Date 4-12-78

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W.O. 044687-000
REVISION 3
April 12, 1978

RECORD OF CHANGE
FOR
SAFETY RELATED HVAC SYSTEM DUCTWORK

REVISION 3

Sheet 1 of 1
April 12, 1978

REVISION 3 includes updated pages only. Latest changes are referenced in the right-hand margin of the updated pages.

CONTENTS page

ATTACHMENTS

Added the following:

"GAI KRSKO 'Design Criteria for Supports of Seismic Ductwork' (Rev. 1 dated April 5, 1978)"

3.0 DESIGN REQUIREMENTS

3.1 This Item revised as shown.

3.2 This Item revised as shown.

ATTACHMENTS

Added Rev. 1 dated April 5, 1978 of "Design Criteria for Supports of Seismic Ductwork."

RECORD OF CHANGE
FOR
SAFETY RELATED HVAC SYSTEM DUCTWORK

REVISION 2

September 29, 1977

Revision 1 is a complete reissue with the exception of the Attachment Specifications. Latest changes are referenced in the right-hand margin of the updated page.

CONTENTS page

ATTACHMENTS

Under Specifications added the following:

"SP-A322-044687-001, 'Painting Exterior and Interior Surfaces of Secondary Plant and Equipment.' (Rev. 2)

SP-B510-044687-000, 'Safety Related and Reactor Building Ductwork Expansion Joints.'"

1.0 SCOPE

1.2 Equipment, Material, and Services to be Furnished by the Supplier Subcontractor

Subitem b.: revised as shown.

1.3 Equipment, Material, and Services to be Furnished by Others

Subitem e.: revised as shown.

1.4 Information Required with the Proposal

Added subitem d. as shown.

2.0 APPLICABLE DOCUMENTS

2.2 Applicable Codes and Standards

Subitem a.: added subitems a.4. through a.7.

Subitem d.: revised as shown.

2.3 Drawings

Drawings in Drawing List revised, added, and deleted as shown.

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ATTACHMENTS

Specifications

SP-A322-044687-001, "Painting Exterior and Interior Surfaces of Secondary Plant and Equipment"

SP-A501-044687-000, "Painting of Equipment in Containment and Auxiliary Buildings"

SP-B510-044687-000, "Safety Related and Reactor Building Ductwork Expansion Joints"

SP-S702-044687-000, "Seismic Analysis, Testing, and Documentation"

Drawings as listed in Item 2.3

GAI KRSKO "Design Criteria for Supports of Seismic Ductwork" (Rev. 1 dated April 5, 1978) | 3

Equipment Specification Exceptions form (1 page)

1.0 SCOPE

1.1 Scope of Work

This Specification includes the information required for furnishing and fabrication of safety related ductwork, hangers, and accessories for the KRSKO Nuclear Power Plant.

1.2 Equipment, Material, and Services to be Furnished by the Supplier/Subcontractor

The equipment, material, accessories, and services shall include, but not necessarily be limited to, the following:

a. Furnishing and fabricating of ductwork and internal and external reinforcing.

b. Designing, furnishing, and fabricating of hangers, supports, and supplemental steel for attaching hangers or supports to main building steel. | 2

c. Duct support and hanger's design calculations.

d. Furnishing, fabricating, and installing of access doors in ductwork.

e. Furnishing splitter dampers, manual dampers, gaskets where required, turning vanes, transverse section connection bolts or clips, and connecting flanges.

f. Furnishing fire dampers for ductwork as indicated on the Drawings and as specified herein.

g. Furnishing gravity dampers as indicated on the Drawings and as specified herein.

1.3 Equipment, Material, and Services to be Furnished by Others

The following equipment, material, and services will be furnished by Others:

a. Installation of ductwork, supports, and duct-mounted accessories not furnished by the SUPPLIER/SUBCONTRACTOR.

b. DELETED.

c. Fans, air handling units, and filter plenums.

d. Ductwork expansion joints.

e. Grilles, registers, diffusers, and wire mesh. | 2

f. Unloading, handling, and rigging at the JOBSITE.

g. Furnishing automatic control dampers.

h. Finish painting of ductwork and duct supports and hangers for installation inside the reactor building.

1.4 Information Required with the Proposal

The following information shall be provided with the Proposal:

a. Estimated gage and weight of fabricated ductwork, hangers, and supports.

b. Illustrations and complete construction data for balancing and fire dampers.

c. All deviations or exceptions to this Specification listed on the Equipment Specification Exceptions form, in accordance with the WESTINGHOUSE KRSKO Standard Purchase/General Order Notes.

d. Price per unit weight of hangers and supports. | 2

2.0 APPLICABLE DOCUMENTS

2.1 Supplemental Specifications and Information

2.1.1 Items attached, as listed on the contents page, are hereby made a part of this Technical Specification. Where conflict exists between an attachment and this Technical Specification, this Technical Specification shall take precedence.

2.1.2 The following WESTINGHOUSE Process Specifications are required as specified:

a. Process Specification PS 85310 QA, Revision 3, "Packaging and Preparing Nuclear Components and Spare Parts for Shipment and Storage."

b. Process Specification PS 292722 (83318 NA), Revision 7, "Cleaning and Packaging Requirements of Equipment for Use in Nuclear Steam Supply System."

c. Process Specification PS 597755, "Application of Protective Coatings to Reactor Containment and System Components in the Reactor Containment."

f. National Electrical Manufacturer's Association (NEMA) ST 1-1972, "Specialty Transformers."

g. American Nuclear Society (ANS) standards as of October 1, 1973.

2.3 Drawings

The following Gilbert Associates, Inc. Drawings, bearing W.O. 04-4687-000, show the preliminary ductwork layouts and associated information necessary for submitting bids and are hereby made a part of this Specification as reference drawings:

Drawing No.	Rev.	Date	Status	Title
E-922-100	0	9-24-76		Building Service - VA, VP Systems HVAC Systems Legend and Schedules
E-922-101	B	7-25-77		Building Service - VA72101 HVAC System Reactor Building - Containment Recirculation System Above El. 115.55
E-922-102	A	8-3-77		Building Service - VA72101 HVAC System Reactor Building - Containment Recirculation System Above El. 132.300
E-922-161	C	9-1-77		Building Service - VA72161 HVAC System Reactor Building H_2 Control System 2
E-922-171	0	10-18-76		Building Service - VA72171 HVAC System R.B. Purge Supply and Exhaust System Intermediate Building - West El. 115.55
E-922-181	1	9-13-77		Building Service - VA 72181 HVAC System R.B. Annulus Negative Pressure Control System - Aux. Bldg El. 115.55
E-922-182	1	9-13-77		Building Service - VA72181 HVAC System R.B. Annulus Negative Pressure Control System - Aux. Bldg. El. 107.62

Drawing No.	Rev.	Date	Status	Title
E-922-183	1	9-13-77		Building Service VA72181 HVAC System R.B. Annulus Negative Pressure Control System - Annulus
E-922-235	DELETED			
E-922-249	1	9-13-77		Building Service - VA72241 HVAC System A.B. Charcoal Cleaning Exhaust System - A.B. East El. 115.55
E-922-251	0	4-30-76		Building Service - VA72251 HVAC System Aux. Bldg. Safety Related Pump Rooms Cooling System - Rhr & Cont. Spray Pump Rooms El. 86.00
E-922-252	0	4-30-76		Buiding Service - VA72251 HVAC System Aux. Bldg. Safety Related Pump Rooms Cooling System - Charging & S.I. Pump Rooms El. 94.21
E-922-431	1	9-13-77		Building Service - VA 72431 HVAC System Fuel Handling Bldg. - Spent Fuel Pit Supply Air System - Aux. Bldg. East NNO Fuel Bldg. El. 115.55 2
E-922-441	1	9-13-77		Building Service - VA72441 HVAC System Fuel Handling Building Spent Fuel Pit Area Char. Clng. Exh. Sys. Fuel Handling Building East El. 103.70 & 107.62
E-922-442	1	9-13-77		Building Service - VA72441 HVAC System Fuel Handling Building Spent Fuel Pit Area Charcoal Clng. Exhaust Sys. Aux. Bldg. East El. 115.55
E-922-443	1	9-13-77		Building Service - VA72441 HVAC System Fuel Handling Building - Spent Fuel Pit Area Charcoal Clng. Exh. Sys. - F.H.B. West El. 115.55

Drawing No.	Rev.	Date	Status	Title	
E-922-511	1	8-24-77		Building Service - VA72511 HVAC System Control Building Relief & Exhaust System Elevations 100.30, 104.87 & 111.89	
E-922-512	2	8-24-77		Building Service - VA72511 HVAC System Control Building Relief and Exhaust System Elevation 115.55 and 123.77	
E-922-521	2	9-13-77		Building Service - VA72521 HVAC System Control Building Main Control Room Charcoal Clean Up System Intmd. Bldg. East El. 119.82 Cont. Bldg. El. 115.55	
E-922-522	0	5-3-77		Building Service - VA72521 HVAC System Control Bldg. Main Control Room Charcoal Cleanup System Intermediate Bldg. East El. 124.77 and Control Bldg. El. 123.77	
E-922-531	0	4-13-77		Building Service - VA72531 HVAC System Control Building Main Control Room Air Conditioning System Intermediate Building East El. 107.62	2
E-922-532	0	4-13-77		Building Service - VA72531 HVAC System Control Building Main Control Room Air Conditioning System Els. 115.55, 119.05 & 123.77	
E-922-541	0	10-28-76		Building Service - VA72541 HVAC System Control Building Electrical Rooms Cooling System Intermediate Bldg. East & Control Bldg. El. 107.62	

Drawing No.	Rev.	Date	Status	Title
E-922-542	0	10-28-76		Building Service - VA72541 HVAC System Control Building Electrical Rooms Cooling System Control Bldg. El. 111.89 & Intermediate Bldg. East El. 115.55
E-922-543	0	10-28-76		Building Service - VA72541 HVAC System Control Building Electrical Rooms Cooling System Sections
E-922-561	1	8-25-77		Building Service - VA72561 HVAC System Control Building Controlled Access Area Ventilating System El. 100.30
E-922-571	1	8-25-77		Building Service - VA72571 HVAC System Cont Bldg. Controlled Access Area Charcoal Clng. Exh. System Intmd. Bldg. East El. 115.55 2
E-922-581	0	9-7-76		Building Service - VA72581 HVAC System Control Building Battery Rooms Ventilating System Intermediate Building East & West El. 100.30
E-922-631	DELETED			
E-922-701	0	8-25-77		Building Service - VA72701 HVAC System Diesel Generator Building Cooling System Floor El. 100.30 and Roof El. 107.62
E-922-721	0	8-15-77		Building Service - VA72721 HVAC System - Essential Service Water Intake Structure Cooling System

Drawing No.	Rev.	Date	Status	Title
E-922-741	2	8-31-77		Building Service - VA72741 HVAC System Auxiliary Building HEPA Exhaust System Plant Vent - Auxiliary Building Plant Roof El. 123.17
E-922-742	2	6-24-77		Building Service - VA72741 HVAC System Auxiliary Building HEPA Exhaust System Plant Vent Intermediate Building East & West El. 123.77
E-922-751	1	8-31-77		Building Service - VA72751 HVAC System Component Cooling Building Cooling System El. 100.30
E-922-752	0	9-8-76		Building Service - VA72511 HVAC System Component Cooling Building Cool System El. 94.21

3.0 DESIGN REQUIREMENTS

3.1 All ductwork shall be constructed as shown on the Drawings and schedules listed in Item 2.3. No deviations are permitted without ENGINEER approval.

3.2 System ductwork, duct support, and hanger detail design drawings shall not be used for fabrication unless checked and issued for construction, and unless primary dimensions are field verified. Ductwork supports shall be designed in accordance with the attached GAI KRSKO, "Design Criteria for Supports of Seismic Ductwork." 3

3.3 Balancing dampers, and fire dampers and gravity dampers furnished under this Contract are subject to the seismic requirements of Specification SP-S702-044687-000.

3.4 Ductwork not supplied in Yugoslavia shall be fabricated for knocked-down (KD) shipment.

4.0 MATERIALS AND DETAILS OF CONSTRUCTION

4.1 The SUPPLIER/SUBCONTRACTOR shall submit a list of material for the construction of ducts, supports, and hangers and for the metal parts of accessories specified herein to WESTINGHOUSE for approval prior to fabrication. The material list shall include ASTM identification numbers and grades.

4.2 Ductwork on the interior of all buildings, except the reactor building shall be constructed of galvanized sheet steel conforming to ASTM A 525 and A 527, and ductwork inside the reactor building and on the exterior of all other buildings shall be constructed of black sheet steel, as qualified under Item 4.5. Construction shall conform to the requirements of Drawings S-922-001, S-922-002, S-922-003, S-922-004, S-922-005, S-922-006, S-922-007, S-922-008, and S-922-009. Open corners at flanged joints shall not be allowed. Open corners shall have corner piece brazed or welded into place, with weld ground smooth. Nongalvanized sheet steel shall be treated in accordance with Item 7.2. 2

4.2A Where indicated on the Drawings, turning vanes in 90° square or 90° round mitered elbows shall be the double thickness type. Where indicated on the Drawings, short radius elbows shall have single vanes in accordance with SMACNA standards. All other elbows shall be nonvaned long radius type in accordance with SMACNA standards.

4.3 Ductwork fabricated under this Specification has an ANS safety classification as indicated on the Drawings.

4.4 Supports and hangers for ducts shall be constructed of structural steel conforming to ASTM A 36.

4.5 Prior to shipment of material, the SUPPLIER/SUBCONTRACTOR shall furnish WESTINGHOUSE with three original copies of the certificate of compliance stating that the physical and chemical characteristics are in accordance with the specification for the material to be used.

4.6 Access doors shall be provided where indicated on the Drawings. Each access door shall be provided with air seal gaskets around the perimeter, and shall be secured to ductwork with hinges and sash locks. Gaskets shall be ASTM D 1056, Grade SCE-45, 50 durometer sponge neoprene. 2

4.7 Where indicated on the Drawings, equipment manual rectangular isolation dampers shall be the opposed-blade type with stainless steel blade and edge seals. Each damper shall be provided with adjustable linkage and an indicating-type locking operator. Dampers for use outside the reactor building shall be constructed with galvanized steel. Dampers for use inside the reactor building shall be constructed with stainless steel. All bearings shall be the stainless steel sleeve type with neoprene seals. Each damper shall have welded to the mounting frame a metal tag stamped with the damper identification number as indicated on the Drawings. Isolation dampers shall be Pacific Air Products Company NU-CON-SMD type or ENGINEER approved equal.

4.7A Remaining manual rectangular balancing dampers shall be the same as those listed in Item 4.7 except that blade and edge seals are not required.

4.7B Round manual dampers shall be provided with an indicating-type locking hand operator. Dampers for use outside the reactor building shall be constructed with galvanized steel. Dampers inside the reactor building shall be constructed of stainless steel. All bearings shall be the stainless steel sleeve type with neoprene seals. Dampers shall have welded to the mounting frame a metal tag stamped with the damper identification number as indicated on the Drawings. Dampers shall be Pacific Air Products NU-CON-RHD or ENGINEER approved equal.

4.8 DELETED.

4.9 Fire dampers shall be furnished where indicated on the Drawings. They shall have galvanized steel curtain type dampers and frames. Dampers for installation in a horizontal plane shall have stainless steel closure springs and a lock to maintain the damper in a closed position after it has been actuated. All fire dampers shall be constructed in accordance with NFPA Bulletin 90A specifications and shall bear the seal of the Underwriters' Laboratories, Inc. Fire dampers shall be Fire/Seal Type AL Model 119, for 1-1/2-hour rating and vertical Model 319P for 3-hour rating, as manufactured by Air Balance, Inc., or EQUAL. 2

4.10 Back draft dampers shall be counterbalanced multiblade type. Counterbalance shall be capable of field adjustment. Bearings shall be capable of field lubrication. The SUPPLIER/SUBCONTRACTOR shall obtain from the damper manufacturer a list of recommended lubricants. Dampers for use inside the reactor building shall be constructed entirely of stainless steel. Dampers for use outside the reactor building shall be constructed of galvanized steel. Counterweights and blade-operating linkage shall be located outside the damper mounting frame and shall not project into the air stream. Each damper shall be provided with a metal tag, welded to the mounting frame, indicating the identification number of the damper as indicated on the Drawings. Identification shall be permanently stamped into the tag. Dampers shall be Type SHW-P-7638, as manufactured by American Warming and Ventilating Co. Inc., or EQUAL.

4.11 Air extractors shall be fully adjustable with "gang-operated" blades constructed with galvanized steel and shall have lockable, manually adjustable operators. Unit shall be Titus Model AG-225 or ENGINEER approved equal.

4.12 Divertors or splitter dampers shall be shop fabricated of galvanized steel minimum 10-gage thickness and shall have splitter-damper mechanism as manufactured by Vent Fabrics Inc., Model 690 or ENGINEER approved equal.

4.13 Flow-measuring devices used on all buildings except the reactor building shall be constructed with galvanized steel. Units used inside the reactor building shall be constructed with stainless steel. The unit shall be complete with air straightener, static and total pressure-sensing manifolds, internal piping, and external pressure transmission parts with fittings and plugs. The maximum allowable pressure loss through the unit shall not exceed 0.08 inches of water at 1500 feet per minute (fpm). The unit shall be Air Monitor Corporation Type D.A.M.D. or Fan E or ENGINEER approved equal. 2 2

4.14 Air blender shall be constructed of galvanized steel. Frame shall be minimum thickness of 16 gage and maximum allowable blender pressure loss shall be 0.2 inches water gage at 1500 fpm. Units shall be R.M. Products Company, Denver, Colorado or ENGINEER approved equal.

4.15 Safety related expansion joints shall be as indicated in Specification SP-B510-044687-000.

4.16 Ductwork sealants shall be the equivalent of Thiokol LP (Liquid Polysulfide Polymer), as manufactured by Thiokol Chemical Corporation. 2

4.17 Gaskets for use at ductwork field joints shall be made from 1/4-inch thick neoprene conforming to ASTM D 1056, grade SCE 45 and 50 to 60 durometer.

5.0 FABRICATION PROCEDURES

5.1 The SUPPLIER/SUBCONTRACTOR shall submit fabrication and welding procedures to WESTINGHOUSE for approval prior to start of fabrication. Required procedures shall include welding of light gage galvanized sheet steel, welding of light gage galvanized sheet steel to structural steel angles, and repair of galvanized steel surfaces after welding.

5.2 Welders shall be qualified to the above procedures and to AWS D1.1 for welding duct supports and hangers. Welder qualifications shall be submitted to WESTINGHOUSE. 2

5.3 Duct construction indicated and detailed on the Drawings has been seismically qualified by the ENGINEER. Any deviation from these designs shall be reported in writing to the ENGINEER prior to fabrication of the revised item. Deviation information reported to the ENGINEER shall include size and length of all structural members, ASTM number of steel, weight to be supported, and all data required to seismically analyze the revised item.

6.0 TESTING, INSPECTION, AND ACCEPTANCE CRITERIA

6.1 Testing, inspection, and acceptance criteria shall conform to the applicable codes and standards as specified in Item 2.2.

6.2 The duct and duct support and hanger's steel welding inspections shall include visual examination of preparations, welding processes, and post welding operations.

6.3 Procedures shall be established to control the purchase, storage, issue, and use of welding electrodes in accordance with AWS D1.1. | 2

6.4 Weld repairs necessitated by visual examinations shall be made in accordance with the procedure used to perform the original weld or a qualified repair procedure, and shall be reinspected. Reinspection shall be by original method and shall conform to the original acceptance criteria.

7.0 PREPARATION FOR SHIPMENT

7.1 Cleanliness

Equipment cleanliness shall be in accordance with WESTINGHOUSE Process Specification PS 292722.

7.2 Painting

7.2.1 Ductwork for installation in the reactor building shall be painted with one prime coat in accordance with the requirements of Specification SP-A501-044687-000. Ductwork inside the battery rooms shall be painted with Class 1 prime coat as described in Specification SP-A501-044687-000. Final coat painting will be by Others. Prime coat shall be applied to the inside and outside surfaces of the ductwork. | 2

7.2.2 Duct supports and hangers and metal parts installed on the interior of all other buildings shall be painted with one prime coat in accordance with Specification SP-A501-044687-000. |

7.2.3 Galvanized metal outside containment shall not be painted.

7.2.4 Ductwork, duct supports and hangers, and metal parts installed on the exterior of the buildings shall be painted with one prime coat in accordance with the requirements of Specification SP-A322-044687-001. | 2

7.3 Packaging and Storage

Ductwork, supports, and accessories shall be packed and handled in accordance with the requirements of WESTINGHOUSE Process Specifications PS 292722 and PS 85310 QA.

KRSKO Duct Support Criteria
January 28, 1977
REVISION 1
April 5, 1978

DESIGN CRITERIA FOR SUPPORTS OF SEISMIC DUCTWORK

The accompanying tables show the maximum transverse and longitudinal support spacing and corresponding loads on supports for the duct sizes and seismic groups listed. Additional tables have been provided which list seismic data and unit weights of the ductwork and appurtenances. A sketch has been included to identify the vertical, horizontal and longitudinal axes for both risers and horizontal duct runs.

GENERAL

The ductwork has been qualified for a combination of dead load plus three directions of seismic acceleration. Under this loading combination, the maximum stress in the duct is not permitted to exceed an allowable stress which is generally based on the buckling strength of a duct panel between adjacent reinforcing angles. The maximum transverse and longitudinal support spacings listed in the tables satisfy the criteria for the seismic group and duct sizes listed. It should be noted that within each seismic group there are separate tables for horizontal duct runs and for risers. For a given duct size and seismic group, there is a difference between the maximum support spacing for a horizontal run and that for a riser.

The spacing of supports should not exceed the values shown but may be less if design or field conditions dictate. In addition, supports should be provided at all bends, changes in duct size, and at any heavy concentrated loads. At least one longitudinal support should be placed within each straight run. Additionally, a longitudinal support is required between each pair of expansion joints or flexible connections. All longitudinal supports should be braced in the longitudinal direction. It is not necessary to place a support immediately adjacent to the free end of a duct run, however, any cantilever should not exceed 25% of the maximum support spacing for that duct size and seismic group.

The loads shown in the tables were computed based upon the peak seismic coefficients for each group and the maximum support spacing listed for the duct. If spacing of the supports is reduced during support design, the corresponding loads can be reduced linearly according to the ratio of the reduced spacing to the maximum support spacing. It should be noted that the horizontal and vertical loads can only be reduced when the transverse support spacing is less than the maximum and similarly the longitudinal loads can be decreased only when the longitudinal support spacing has been reduced. Since the loads on the supports can act in either direction along three orthogonal axes, several combinations of loading must be investigated to determine the combinations which result in the most severe support design. It should be noted that different loading combinations may control different members within a given support.

The ducts are listed in the table by nominal dimensions. The actual duct sizes have been rounded off to the nearest 5 centimeters. If a duct size was not included in a specific seismic group, the required data may be taken from the next highest seismic group or interpolated between two adjacent sizes in the same seismic group.

SEISMIC DATA

For convenience, the ductwork was analyzed by seismic group. These seismic groups include all ductwork found in a given set of buildings between specific elevations. The buildings and controlling elevations are listed in the table of seismic data. Also listed are the horizontal and vertical seismic coefficients for each group. With the exception of group 7, the groups are arranged in ascending order based on the magnitude of the seismic coefficients. Group 7 is actually the lowest group and includes seismic ductwork below grade.

The seismic coefficients are in terms of the Operating Basis Earthquake (OBE) only. If the Safe Shutdown Earthquake (SSE) gave a more severe seismic condition, it was converted to an OBE coefficient which would give the same or more conservative results. Since all of the analysis was done in terms of the OBE, the supports can be designed using the allowable working stress (elastic) method.

When a given duct size occurred in adjacent seismic groups with coefficients of approximately the same magnitude, this size was analyzed only for the higher group; e.g. a duct size found in both groups 2 and 3 was analyzed-for group 3 only.

FOR HORIZONTAL DUCT RUNS

Transverse supports are loaded along the horizontal and vertical axes while longitudinal supports are loaded along all three axes. The maximum horizontal and longitudinal loads can act in either direction along the corresponding axes. Due to the dead weight of the duct, the maximum vertical load acts only in the downward (positive) direction. Depending on the magnitude of the vertical seismic coefficient, the minumum vertical load can be either positive or negative.

FOR RISERS

Transverse supports are loaded along both horizontal axes while longitudinal supports are loaded along all three axes. For the two horizontal axes, the maximum load can act in either direction. Due to the dead weight of the duct, the maximum longitudinal load acts only in the downward (positive) direction. Depending upon the magnitude of the vertical seismic coefficient, the minimum longitudinal load can be either positive or negative.

APPURTENANCES

To accommodate grilles, registers and other appurtenances, the duct loads on supports given in the tables include an allowance for appurtenances. A table of unit weights has been provided which lists a Maximum Allowable Unit Weight of appurtenances (W_a) for each duct size. The allowable is given in terms of kilograms per meter of duct. For a given transverse support spacing (ℓ) this distributed weight can be converted into an allowable concentrated load (P_a) at midspan by the equation $P_a = \frac{W_a \ell}{2}$. This allowable concentrated load can then be used to determine if an additional support is required. 1 1

LARGE CONCENTRATED LOADS

If a concentrated load exceeds the value of P_a, a support must be provided at the concentrated load. The loads on the support in a given direction can be determined by multiplying the concentrated load by the peak seismic coefficient in that direction. 1

REDUCTION OF LOADS

For loads acting along the longitudinal axis of the duct, a reduction in load is possible based on a frequency check. If the natural frequency of the duct and supports exceeds 20 cps, the seismic coefficient at 20 cps can be used in lieu of the peak seismic value.

CONNECTION OF DUCT TO SUPPORTS

For Transverse Supports, the duct can either be boxed in tightly by angles on all four sides or attached to angles on two opposite sides. For Longitudinal Supports, the duct must be attached on two opposite sides even if it is boxed in on all four sides. Where attachment is required, welding is preferred.

To insure the integrity of round ducts, they should be supported using angles curved to the outside radius of the duct. A semicircular angle is required to support the lower half of the duct in a horizontal run. For risers, a circular support should be provided all around the duct to transfer the load without crushing the duct.

SPECIAL DUCT CONSTRUCTION

Due to high operating pressures or accident conditions, several ducts require special duct construction. These ducts are identified by a footnote in the tables.

DUCTS ON ROOFS 1

Several horizontal ducts are located on the roofs of the Auxiliary and Intermediate Buildings. Consequently, they are exposed to the weather and subject to wind, snow, and ice loading. The effects of these loads were included in the computation of the maximum support spacing and duct loads on supports for these ducts. The horizontal ducts on roofs are identified by a footnote in the tables.

SEISMIC DATA

SEISMIC GROUP	BUILDINGS	CONTROLLING ELEVATIONS	SEISMIC COEFFICIENTS HORIZONTAL PEAK	HORIZONTAL @ 20 cps	VERTICAL PEAK	VERTICAL @ 20 cps
1	All	100.30 M to 107.62 M	1.5	0.5	0.95	0.35
2	Auxiliary Bldg Fuel Handling Bldg (Spent Fuel Area) Component Cooling Bldg	Above 107.62	1.75	0.5	0.95	0.35
3	Intermediate Bldg Control Bldg	Above 107.62 M	2.0	0.65	0.95	0.35
4	Reactor Bldg - Interior Concrete	Above 107.62 M	2.5	0.8	0.95	0.5
5	Containment Vessel & Shield Bldg Exterior Wall	107.62 M to 133.0 M	5.0	1.0	0.95	0.5
6	Containment Vessel & Shield Bldg Exterior Wall	Above 133.0 M	6.0	1.0	2.0	0.5
7	All	Below 100.30 M	1.25	0.35	0.95	0.35

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NOTE: For Horizontal Duct Runs: Longitudinal seismic coefficients are same as horizontal coefficients shown above.

For Risers: Longitudinal seismic coefficients are same as vertical seismic coefficients shown above.

UNIT WEIGHT OF DUCT AND APPURTENANCES

NOMINAL DUCT DIMENSION W x H cm x cm	THICKNESS t cm	UNIT WEIGHT OF DUCT & APPURTENANCES w kg/M	MAXIMUM ALLOWABLE UNIT WEIGHT OF APPURTENANCES Wa kg/M
350 x 100	0.15	317	54.9
305 x 25	↑	232	40.3
295 x 80	|	264	45.8
270 x 120	|	275	47.6
245 x 150	|	278	48.2
225 x 105	|	232	65.3
225 x 100	|	229	64.4
225 x 90	|	222	62.4
200 x 90	|	204	57.4
200 x 75	|	194	54.5
200 x 50	|	176	49.5
195 x 150	|	243	68.3
195 x 50	↓	173	48.5
150 x 215	0.15	257	72.3
150 x 150	0.12	175	54.0
150 x 130	↑	164	50.4
150 x 120	|	158	48.6
150 x 105	|	149	45.9
150 x 90	|	140	43.2
150 x 75	|	131	40.5
150 x 60	|	123	37.8
150 x 45	|	114	35.1
150 x 30	|	105	32.4
140 x 75	|	126	38.7
135 x 150	|	166	51.3
135 x 30	0.12	96.4	29.7
120 x 195	0.15	184	62.4
120 x 165	0.12	166	51.3
120 x 120	↑	140	43.2
120 x 105	|	131	40.5
120 x 90	↓	123	37.8
120 x 75	0.12	114	35.1

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UNIT WEIGHT OF DUCT AND APPURTENANCES

NOMINAL DUCT DIMENSION W x H cm x cm	THICKNESS t cm	UNIT WEIGHT OF DUCT & APPURTENANCES w kg/M	MAXIMUM ALLOWABLE UNIT WEIGHT OF APPURTENANCES Wa kg/M
120 x 60	0.12	105	32.4
120 x 45		96.4	29.7
110 x 110		129	39.6
110 x 105		126	38.7
110 x 95		120	36.9
105 x 105		123	37.8
105 x 75		105	32.4
105 x 60		96.4	29.7
105 x 45		87.6	27.0
105 x 20		73.0	22.5
100 x 120		129	39.6
100 x 90		111	34.2
95 x 45		81.8	25.2
90 x 150		140	43.2
90 x 120		123	37.8
90 x 105		114	35.1
90 x 95		108	33.3
90 x 90		105	42.1
90 x 60		87.6	35.1
90 x 45		78.8	31.6
90 x 40		75.9	30.4
90 x 35		73.0	29.3
90 x 30		70.1	28.1
90 x 20		64.2	25.7
90 x 15		61.3	24.6
80 x 55		78.8	31.6
75 x 180		149	45.9
75 x 165		140	43.2
75 x 105		105	32.4
75 x 100		102	31.5
75 x 90		96.4	38.6
75 x 75	0.12	87.6	35.1

UNIT WEIGHT OF DUCT AND APPURTENANCES

NOMINAL DUCT DIMENSION W x H cm x cm	THICKNESS t cm	UNIT WEIGHT OF DUCT & APPURTENANCES w kg/M	MAXIMUM ALLOWABLE UNIT WEIGHT OF APPURTENANCES Wa kg/M
75 x 60	0.12	78.8	31.6
75 x 45	↑	70.1	28.1
75 x 30	↑	61.3	24.6
75 x 25	↑	58.4	23.4
70 x 70	↑	81.8	32.8
70 x 50	↑	70.1	28.1
70 x 20	↑	52.6	21.1
60 x 165	↑	131	40.5
60 x 150	↑	123	37.8
60 x 90	↑	87.6	35.1
60 x 65	↑	73.0	29.3
60 x 60	↑	70.1	35.5
60 x 55	↑	67.2	34.0
60 x 50	↑	64.2	32.6
60 x 45	↑	61.3	31.1
60 x 40	↑	58.4	29.6
60 x 35	↑	55.5	28.1
60 x 30	↑	52.6	26.6
60 x 25	↑	49.6	25.2
60 x 20	↑	46.7	23.7
60 x 15	↑	43.8	22.2
50 x 165	↑	126	38.7
50 x 50	↑	58.4	29.6
50 x 45	↑	55.5	28.1
50 x 30	↑	46.7	23.7
50 x 25	↑	43.8	22.2
45 x 60	↑	61.3	31.1
45 x 45	↑	52.6	23.4
45 x 30	↑	43.8	19.5
45 x 25	↑	40.9	18.2
45 x 20	↑	38.0	16.9
45 x 15	↑	35.0	15.6
40 x 40	↑	46.7	20.8
40 x 25	0.12	38.0	16.9

UNIT WEIGHT OF DUCT AND APPURTENANCES

NOMINAL DUCT DIMENSION W x H cm x cm	THICKNESS t cm	UNIT WEIGHT OF DUCT & APPURTENANCES w kg/M	MAXIMUM ALLOWABLE UNIT WEIGHT OF APPURTENANCES Wa kg/M
35 x 165	0.12	117	36.0
35 x 35	↑	40.9	18.2
35 x 20		32.1	14.3
30 x 45		43.8	19.5
30 x 35		38.0	16.9
30 x 30		35.0	15.6
30 x 25		32.1	14.3
30 x 20		29.2	13.0
30 x 15		26.3	11.7
25 x 20		26.3	12.3
25 x 15		23.4	11.0
20 x 20	↓	23.4	11.0
20 x 10	0.12	17.5	8.2
ROUND DUCT NOMINAL DIA. cm			
105	0.12	95.7	29.7
75	↑	68.3	27.6
70		64.2	25.7
60		55.0	27.9
50		45.6	23.3
45		41.0	18.4
40	↓	36.5	16.3
25	0.12	22.9	10.8

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UNIT WEIGHT OF DUCT AND APPURTENANCES

NOMINAL DUCT DIMENSION W x H cm x cm	THICKNESS t cm	UNIT WEIGHT OF DUCT & APPURTENANCES w kg/M	MAXIMUM ALLOWABLE UNIT WEIGHT OF APPURTENANCES Wa kg/M
300 x 230	0.15	373	65.0
230 x 230	↑	324	91.0
140 x 200*	↓	239	67.0
140 x 185*	0.15	229	64.0
120 x 115	0.12	137	42.0
110 x 200*	0.15	218	61.0
90 x 200*	↑	204	57.0
90 x 135*	↓	158	41.0
90 x 60*	↓	106	35.0
85 x 90*	↓	123	41.0
60 x 200*	↓	183	52.0
50 x 90*	0.15	99	33.0
ROUND DUCT NOMINAL DIA. cm			
200*	0.15	221	62.0
169	0.15	187	48.0
168*	0.15	186	47.0
90*	0.12	83	33.0
10	0.12	9.2	4.3

NOTE: *Special duct construction.

SEISMIC GROUP 1 - HORIZONTAL DUCTS
(All buildings between El. 100.30 M and El. 107.62 M)

NOMINAL DUCT DIMENSIONS W x H cm x cm	MAXIMUM SUPPORT SPACING TRANSVERSE SUPPORTS M	MAXIMUM SUPPORT SPACING LONGITUDINAL SUPPORTS M	DUCT LOADS ON SUPPORTS HORIZONTAL ± kg	VERTICAL MAX kg	VERTICAL MIN kg	LONGITUDINAL ± kg
200 x 50	2.6	9.2	690	895	20	2430
195 x 50	2.6	9.7	675	880	20	2515
150 x 215	3.5	14.0	1350	1755	45	5400
150 x 45	2.0	6.6	345	445	10	1130
150 x 30	1.7	6.7	265	350	10	1055
135 x 30	1.8	7.5	260	335	10	1080
120 x 195	3.5	14.0	965	1255	30	3865
120 x 120	2.9	9.1	610	790	20	1910
120 x 105	2.8	9.0	550	715	20	1770
120 x 90	2.7	8.7	500	650	15	1605
105 x 60	2.5	7.9	360	470	10	1140
105 x 45	2.3	7.4	305	395	10	975
105 x 20	1.7	7.2	185	240	5	790
90 x 60	1.6	5.8	210	275	5	765
90 x 35	1.5	5.4	165	215	5	590
90 x 30	1.4	5.7	145	190	5	600
75 x 90	1.9	5.8	275	355	10	855
75 x 60	2.0	6.4	235	310	10	760
75 x 30	2.1	6.5	190	250	5	595
75 x 25	1.5	6.4	130	170	5	555
70 x 20	1.5	6.4	120	155	5	510
60 x 65	2.2	8.1	240	315	10	885
60 x 55	2.0	8.5	200	261	5	855
60 x 25	1.6	7.5	120	155	5	565
60 x 20	1.5	6.9	105	140	5	485
50 x 25	1.9	9.0	125	165	5	595
45 x 20	1.9	11.4	110	140	5	650
40 x 25	2.3	10.7	130	170	5	610
35 x 35	2.8	13.0	170	225	5	800
30 x 35	2.7	12.7	155	200	5	725
30 x 20	2.7	13.5	120	155	5	585
20 x 20	3.0	15.0	105	135	5	520
20 x 10	3.0	15.0	80	105	5	405
300 x 230	3.0	9.0	1680	2180	55	5035
230 x 230	3.0	9.0	1460	1895	50	4375
ROUND DUCT NOMINAL DIA. cm						
169	4.0	12.0	1120	1460	35	3365

SEISMIC GROUP 1 - RISERS
(All Buildings between El. 100.30 M and El. 107.62 M)

NOMINAL DUCT DIMENSIONS W x H cm x cm	MAXIMUM SUPPORT SPACING TRANSVERSE SUPPORTS M	MAXIMUM SUPPORT SPACING LONGITUDINAL SUPPORTS M	DUCT LOADS ON SUPPORTS HORIZONTAL ± kg	DUCT LOADS ON SUPPORTS LONGITUDINAL MAX kg	DUCT LOADS ON SUPPORTS LONGITUDINAL MIN kg
200 x 50	2.0	6.0	530	2060	50
195 x 50	2.0	6.0	520	2025	50
150 x 30	1.3	3.9	205	800	20
105 x 45	1.8	5.4	240	925	25
90 x 35	1.1	3.3	120	470	10
75 x 30	1.3	3.9	120	465	10
75 x 25	1.2	3.6	105	410	10
60 x 65	1.7	5.1	170	665	15
60 x 40	1.5	4.5	130	510	15
35 x 35	2.6	7.8	160	625	15

SEISMIC GROUP 2 - HORIZONTAL DUCTS

(Auxiliary Building, Spent Fuel Area, and Component Cooling Building above El. 107.62 M) 1

NOMINAL DUCT DIMENSIONS W x H cm x cm	MAXIMUM SUPPORT SPACING TRANSVERSE SUPPORTS M	MAXIMUM SUPPORT SPACING LONGITUDINAL SUPPORTS M	DUCT LOADS ON SUPPORTS HORIZONTAL ± kg	VERTICAL MAX kg	VERTICAL MIN kg	LONGITUDINAL ± kg	
305 x 25	2.0	6.0	815	905	25	2435	
270 x 120	3.5	10.6	1685	1875	50	5100	
245 x 150	3.5	13.7	1705	1895	50	6665	
225 x 105	3.4	10.8	1380	1540	40	4385	
200 x 75	2.9	10.0	985	1095	30	3395	
150 x 150	2.7	8.1	825	920	25	2480	
150 x 120	2.5	8.5	690	770	20	2350	
140 x 75	2.4	7.2	530	590	15	1590	
140 x 60	2.3	7.2	470	525	15	1475	
120 x 75	2.5	8.5	500	555	15	1695	
100 x 120	2.7	8.9	610	680	15	2010	
90 x 40	1.5	5.9	200	220	5	785	
75 x 180	2.3	7.7	600	670	15	2010	
75 x 105	2.6	8.1	480	530	15	1450	
70 x 50	1.9	8.1	230	260	5	990	
60 x 65	2.4	8.0	475	530	15	1580	
60 x 50	1.9	8.2	210	235	5	920	
60 x 40	1.8	7.9	185	205	5	800	
50 x 165	2.1	7.0	465	515	15	1545	
50 x 45	2.2	8.8	210	235	5	845	
50 x 30	2.0	7.3	165	185	5	600	
45 x 45	2.4	9.1	225	250	5	845	
45 x 25	2.0	11.0	145	160	5	790	
40 x 40	2.5	13.0	205	230	5	1070	
35 x 165	1.6	5.0	330	365	10	1025	
35 x 20	2.3	14.0	130	145	5	785	
25 x 20	3.0	15.0	135	150	5	685	
120 x 115	3.0	9.0	720	800	20	2155	
270 x 120*	2.2	6.6	2075	2310	60	6225	
245 x 150*	2.5	7.5	2260	2520	65	6785	
225 x 105*	2.2	6.6	1740	1940	50	5220	
150 x 150*	1.8	5.4	1010	1125	30	3035	
150 x 120*	1.6	4.8	850	950	25	2560	
150 x 105*	1.6	4.8	825	920	25	2480	1
120 x 120*	1.9	5.7	855	950	25	2565	
90 x 60*	1.1	3.3	340	380	10	1015	
90 x 20*	0.7	2.1	185	205	5	560	
75 x 105*	1.9	5.7	590	660	15	1775	
75 x 75*	1.4	4.2	395	440	10	1185	
60 x 60*	1.4	4.2	315	350	10	950	

NOTE: *Horizontal ducts on roofs - includes effects of wind, snow, and ice.

SEISMIC GROUP 2 - HORIZONTAL DUCTS
(Auxiliary Building, Spent Fuel Area, and Component Cooling Building above El. 107.62 M) 1

NOMINAL DUCT DIMENSIONS W x H cm x cm	MAXIMUM SUPPORT SPACING TRANSVERSE SUPPORTS M	MAXIMUM SUPPORT SPACING LONGITUDINAL SUPPORTS M	DUCT LOADS ON SUPPORTS HORIZONTAL ± kg	DUCT LOADS ON SUPPORTS VERTICAL MAX kg	DUCT LOADS ON SUPPORTS VERTICAL MIN kg	DUCT LOADS ON SUPPORTS LONGITUDINAL ± kg
ROUND DUCT NOMINAL DIA. cm						
75	6.0	18.0	715	759	20	2145
40	6.0	18.0	390	435	10	1165

SEISMIC GROUP 2 - RISERS

(Auxiliary Building, Spent Fuel Area and Component Cooling Building above El. 107.62 M) 1

NOMINAL DUCT DIMENSIONS W x H cm x cm	MAXIMUM SUPPORT SPACING TRANSVERSE SUPPORTS M	MAXIMUM SUPPORT SPACING LONGITUDINAL SUPPORTS M	DUCT LOADS ON SUPPORTS HORIZONTAL ± kg	DUCT LOADS ON SUPPORTS LONGITUDINAL MAX kg	DUCT LOADS ON SUPPORTS LONGITUDINAL MIN kg	
305 x 25	1.5	4.5	610	2035	50	1
200 x 75	2.0	6.0	680	2270	60	
140 x 60	1.6	4.8	330	1095	30	
120 x 120	1.9	5.7	465	1555	40	
75 x 180	1.5	4.5	390	1310	35	
75 x 105	1.8	5.4	330	1105	30	
75 x 60	1.4	4.2	195	645	15	
60 x 60	1.3	3.9	160	530	15	
60 x 50	1.5	4.5	170	560	15	
60 x 45	1.5	4.5	160	535	15	
60 x 40	1.3	3.9	130	440	10	
60 x 30	1.4	4.2	130	435	10	
45 x 30	1.9	5.7	145	490	15	
40 x 40	2.2	6.6	180	605	15	
30 x 25	2.7	8.1	150	505	15	
120 x 115	2.5	7.5	600	2005	50	

SEISMIC GROUP 3 - HORIZONTAL DUCTS

(Intermediate Building and Control Building above El. 107.62 M) 1

NOMINAL DUCT DIMENSIONS W x H cm x cm	MAXIMUM SUPPORT SPACING TRANSVERSE SUPPORTS M	MAXIMUM SUPPORT SPACING LONGITUDINAL SUPPORTS M	DUCT LOADS ON SUPPORTS HORIZONTAL ± kg	DUCT LOADS ON SUPPORTS VERTICAL MAX kg	DUCT LOADS ON SUPPORTS VERTICAL MIN kg	DUCT LOADS ON SUPPORTS LONGITUDINAL ± kg
350 x 100	2.4	7.2	1520	1485	40	4565
295 x 80	2.8	8.8	1480	1440	35	4645
200 x 90	2.9	8.8	1180	1155	30	3590
195 x 150	3.2	10.3	1555	1515	40	5005
150 x 130	2.4	7.6	785	780	20	2495
150 x 105	2.2	7.3	650	640	15	2160
150 x 90	2.2	6.8	615	600	15	1905
150 x 75	2.1	6.6	550	535	15	1730
150 x 60	2.0	6.3	490	480	10	1550
150 x 30	1.5	6.0	315	305	10	1260
135 x 150	2.3	7.7	765	745	20	2555
120 x 165	2.3	7.6	765	745	20	2525
120 x 120	2.6	8.0	730	710	20	2240
120 x 90	2.4	8.2	590	575	15	2015
120 x 60	2.2	7.5	460	450	10	1575
120 x 45	2.0	6.6	385	375	10	1265
110 x 110	2.6	8.2	670	655	15	2115
110 x 105	2.5	8.8	630	615	15	2220
110 x 95	2.5	8.2	600	585	15	1970
105 x 105	2.5	9.0	615	600	15	2215
105 x 75	2.4	7.8	505	490	15	1640
105 x 60	2.3	7.2	440	430	10	1380
90 x 150	2.2	6.9	615	600	15	1930
90 x 120	2.4	8.2	590	575	15	2015
90 x 105	2.5	8.0	570	555	15	1825
90 x 95	2.5	8.6	540	525	15	1860
90 x 90	1.7	5.7	360	350	10	1195
90 x 60	1.5	4.9	265	255	5	860
90 x 45	1.5	4.8	235	230	5	760
90 x 30	1.3	4.9	180	180	5	685
90 x 20	1.2	3.9	155	150	5	500
90 x 15	1.1	3.4	135	130	5	415
75 x 165	2.1	7.1	590	575	15	1990
75 x 100	2.4	7.7	490	475	10	1570
75 x 75	1.9	6.0	335	325	10	1055
75 x 60	1.7	5.5	270	260	5	870
75 x 45	1.3	6.0	180	175	5	840
60 x 150	2.0	6.4	490	480	10	1575
60 x 90	1.6	5.1	280	275	5	900
60 x 60	1.9	6.8	265	260	5	950
60 x 45	1.8	6.2	220	215	5	755
60 x 35	1.7	5.8	185	180	5	640
60 x 30	1.6	6.2	170	165	5	655

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SEISMIC GROUP 3 - HORIZONTAL DUCT

(Intermediate Building and Control Building above El. 107.62 M) 1

NOMINAL DUCT DIMENSIONS W x H cm x cm	MAXIMUM SUPPORT SPACING TRANSVERSE SUPPORTS M	MAXIMUM SUPPORT SPACING LONGITUDINAL SUPPORTS M	DUCT LOADS ON SUPPORTS HORIZONTAL ± kg	VERTICAL MAX kg	VERTICAL MIN kg	LONGITUDINAL ± kg	
60 x 15	1.4	5.8	125	120	5	510	
45 x 60	1.8	6.1	220	215	5	744	
45 x 30	2.1	6.5	185	180	5	572	
45 x 15	1.7	6.7	120	115	5	470	
30 x 45	2.5	10.0	220	215	5	880	
30 x 30	2.8	12.3	195	190	5	860	
30 x 25	2.7	9.6	175	170	5	615	
30 x 15	2.3	14.0	120	115	5	730	
25 x 15	2.5	15.0	130	125	5	780	
120 x 120*	1.7	5.1	875	850	20	2620	
90 x 60*	1.0	3.0	350	345	10	1055	1
60 x 60*	1.3	3.9	335	325	10	1005	
ROUND DUCT NOMINAL DIA. cm							
60	6.0	18.0	660	645	15	1980	
25	3.7	11.1	170	165	5	510	
10	3.7	11.1	70	65	5	205	1
25*	3.7	11.1	260	255	5	780	

NOTE: *Horizontal ducts on roofs - includes effects of wind, snow, and ice.

SEISMIC GROUP 3 - RISERS
(Intermediate Building and Control Building above El. 107.62 M) 1

NOMINAL DUCT DIMENSIONS W x H cm x cm	MAXIMUM SUPPORT SPACING TRANSVERSE SUPPORTS M	MAXIMUM SUPPORT SPACING LONGITUDINAL SUPPORTS M	DUCT LOADS ON SUPPORTS HORIZONTAL ± kg	DUCT LOADS ON SUPPORTS LONGITUDINAL MAX kg	DUCT LOADS ON SUPPORTS LONGITUDINAL MIN kg	
350 x 100	1.5	4.5	950	2780	70	
295 x 80	2.0	6.0	1055	3090	80	
200 x 90	2.0	6.0	815	2385	60	
150 x 75	1.5	4.5	395	1150	30	
150 x 60	1.4	4.2	345	1010	25	
150 x 30	1.2	3.6	250	740	20	
135 x 150	1.6	4.8	530	1555	40	
120 x 90	1.8	5.4	440	1295	35	
120 x 60	1.6	4.8	335	985	25	
120 x 45	1.6	4.8	305	900	25	1
110 x 110	1.9	5.7	490	1435	35	
110 x 105	1.8	5.4	450	1325	35	
110 x 95	1.8	5.4	430	1265	30	
105 x 75	1.8	5.4	380	1105	30	
90 x 150	1.5	4.5	420	1230	30	
90 x 105	1.8	5.4	410	1200	31	1
90 x 60	1.1	3.3	195	565	15	
90 x 45	1.1	3.3	175	510	15	
75 x 75	1.4	4.2	245	720	20	
75 x 45	1.1	3.3	155	450	10	
60 x 150	1.4	4.2	345	1010	25	
60 x 90	1.1	3.3	195	565	15	1
60 x 45	1.4	4.2	170	500	15	
60 x 30	1.3	3.9	140	405	10	
45 x 30	1.8	5.4	160	465	10	
45 x 15	1.5	4.5	105	310	10	
30 x 45	1.8	5.4	160	465	10	
30 x 30	2.6	7.8	180	530	15	
30 x 15	2.2	6.6	115	335	10	
25 x 15	2.4	7.2	125	365	10	
ROUND DUCT NOMINAL DIA. cm						
25	3.7	11.1	170	495	15	1
10	3.7	11.1	70	200	5	

SEISMIC GROUP 4 - RISERS
(Reactor Building - Interior Concrete above
El. 107.62 M)

ROUND DUCT NOMINAL DIA. cm	MAXIMUM SUPPORT SPACING TRANSVERSE SUPPORTS M	MAXIMUM SUPPORT SPACING LONGITUDINAL SUPPORTS M	DUCT LOADS ON SUPPORTS HORIZONTAL ± kg	DUCT LOADS ON SUPPORTS LONGITUDINAL MAX kg	DUCT LOADS ON SUPPORTS LONGITUDINAL MIN kg
105*	4.0	12.0	960	2245	60

NOTE: *Special duct construction.

1

SEISMIC GROUP 5 - RISERS

(Containment Vessel and Shield Bldg Exterior Wall between El. 107.62 M and El. 133.0 M) 1

NOMINAL DUCT DIMENSIONS W x H cm x cm	MAXIMUM SUPPORT SPACING TRANSVERSE SUPPORTS M	MAXIMUM SUPPORT SPACING LONGITUDINAL SUPPORTS M	DUCT LOADS ON SUPPORTS HORIZONTAL ± kg	DUCT LOADS ON SUPPORTS LONGITUDINAL MAX kg	DUCT LOADS ON SUPPORTS LONGITUDINAL MIN kg	
150 x 60	1.1	3.3	675	790	20	
80 x 55	1.0	3.0	395	460	10	
60 x 45	1.0	3.0	305	355	10	
90 x 60*	1.8	5.4	995	1115	30	1
50 x 90*	1.7	5.1	840	985	25	
ROUND DUCT NOMINAL DIA. cm						
200*	4.0	12.0	4420	5170	135	
168*	4.0	12.0	3720	4350	110	1
90*	4.0	12.0	1660	1940	50	

NOTE: *Special duct construction.

SEISMIC GROUP 6 - HORIZONTAL DUCT

(Containment Vessel and Shield Bldg Exterior Wall above El. 133.0 M) 1

ROUND DUCT NOMINAL DIA.	MAXIMUM SUPPORT SPACING TRANSVERSE SUPPORTS	MAXIMUM SUPPORT SPACING LONGITUDINAL SUPPORTS	DUCT LOADS ON SUPPORTS HORIZONTAL	DUCT LOADS ON SUPPORTS VERTICAL MAX	DUCT LOADS ON SUPPORTS VERTICAL MIN	DUCT LOADS ON SUPPORTS LONGITUDINAL
cm	M	M	± kg	kg	kg	± kg
60*	6.0	18.0	1980	990	-330	5940
50*	6.0	18.0	1655	830	-275	4970

1

NOTE: *Special duct construction.

SEISMIC GROUP 6 - RISERS
(Containment Vessel and Shield Bldg Exterior Wall above El. 133.0 M) 1

ROUND DUCT NOMINAL DIA.	MAXIMUM SUPPORT SPACING TRANSVERSE SUPPORTS	MAXIMUM SUPPORT SPACING LONGITUDINAL SUPPORTS	DUCT LOADS ON SUPPORTS HORIZONTAL	DUCT LOADS ON SUPPORTS LONGITUDINAL MAX	DUCT LOADS ON SUPPORTS LONGITUDINAL MIN
cm	M	M	± kg	kg	kg
60*	4.0	12.0	1320	1980	-660

1

NOTE: *Special duct construction.

SEISMIC GROUP 7 - HORIZONTAL DUCTS
(All Buildings - below El. 100.30 M)

NOMINAL DUCT DIMENSIONS W x H cm x cm	MAXIMUM SUPPORT SPACING TRANSVERSE SUPPORTS M	MAXIMUM SUPPORT SPACING LONGITUDINAL SUPPORTS M	DUCT LOADS ON SUPPORTS HORIZONTAL ± kg	DUCT LOADS ON SUPPORTS VERTICAL MAX kg	DUCT LOADS ON SUPPORTS VERTICAL MIN kg	DUCT LOADS ON SUPPORTS LONGITUDINAL ± kg
225 x 100	3.7	11.5	1060	1650	40	3290
225 x 90	3.5	12.8	970	1515	40	3550
100 x 90	2.9	11.6	400	625	15	1610
95 x 45	2.4	10.3	245	385	10	1055
90 x 90	2.1	7.5	275	430	10	985
90 x 60	1.9	6.5	210	325	10	715
75 x 45	1.9	8.7	165	260	5	760
70 x 70	2.3	9.8	235	370	10	1005
60 x 45	2.1	7.0	160	250	5	535
60 x 40	2.0	8.2	145	225	5	595
50 x 50	2.4	11.8	175	270	5	855
45 x 30	2.3	11.4	125	195	5	625
35 x 35	2.9	15.0	150	230	5	770

SEISMIC GROUP 7 - RISERS
(All Buildings - below 100.30 M)

NOMINAL DUCT DIMENSIONS W x H cm x cm	MAXIMUM SUPPORT SPACING TRANSVERSE SUPPORTS M	MAXIMUM SUPPORT SPACING LONGITUDINAL SUPPORTS M	DUCT LOADS ON SUPPORTS HORIZONTAL ± kg	DUCT LOADS ON SUPPORTS LONGITUDINAL MAX kg	DUCT LOADS ON SUPPORTS LONGITUDINAL MIN kg
225 x 100	2.4	7.2	685	3215	80
225 x 90	2.4	7.2	660	3115	80
100 x 90	2.0	6.0	280	1300	35
95 x 45	1.9	5.7	195	910	25
90 x 90	1.3	3.9	170	800	20
90 x 60	1.2	3.6	130	620	15
75 x 45	1.4	4.2	125	575	15
70 x 70	1.7	5.1	175	815	20
60 x 45	1.6	4.8	120	570	15
60 x 40	1.6	4.8	115	545	15
50 x 50	2.1	6.3	150	715	20
45 x 30	2.1	6.3	115	540	15
35 x 35	2.8	8.4	145	670	15

EQUIPMENT SPECIFICATION
EXCEPTIONS

WESTINGHOUSE POWER SYSTEMS PROJECTS DIVISION
KRSKO NUCLEAR POWER PLANT

The BIDDER certifies that the Proposal is in complete and absolute agreement with this Specification, except as specifically outlined below. (Use additional sheets if required.)

_____
(BIDDER'S NAME)

_____
(MANUFACTURER'S NAME)

_____
(QUOTATION NUMBER)

Attest: _____
(SIGNATURE)

_____
(TITLE)