

## FOR INFORMATION

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PROJECT :

### TWO(2) x 500 MW MONG DUONG 1 THERMAL POWER PLANT

EMPLOYER :



CONSULTANT :



CONTRACTOR :



SUB-CONTRACTOR :



DESIGNED BY	DATE	TITLE :  <b>TECHNICAL INSULATION SPECIFICATION FOR STEAM TURBINE</b>			
H.W.PARK	11-02-15				
CHECKED BY	DATE				
Y.H.WON	11-02-15				
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## **1.0 General Specifications Heat Retention Block Material for Steam Turbine**

### **I. INTRODUCTION**

Heat retention material to be used on steam turbine units shall be in accordance with the heat retention ordering drawing made for each turbine unit and the following general specification. All materials shall be asbestos-free. Use of materials other than that specified must be referred to the Schenectady Turbine-Generator Marketing Operation for approval through usual District Office Procedures.

### **II. HEAT RETENTION MATERIAL DRAWING LIST**

A heat retention ordering drawing giving temperature ranges, reference documents and specifications will be made for each turbine unit listing parts to be insulated. This list will not include unit specific detail drawings and vendors should plan on visiting the factory or job site to obtain actual dimensions as needed for quoting and supplying of required material.

All documents are issued to the Power Systems Sourcing Operation.

#### **A. Insulation Thickness and Temperatures**

The hot surface temperature of all areas to be insulated will be listed on the ordering drawing. It shall be the responsibility of the insulation vendor to select the proper insulation thickness based on application and material selected to produce the specified cold surface temperature.

#### **B. Materials**

In cases where materials other than standard as given in 1.0, INTRODUCTION, of these general specifications are to be used, the drawings will specifically note the exceptions. Use of other materials should be approved as noted in Section 1.0

#### **C. Horizontal and Vertical Shell Joint Flanges**

In general, all joint insulation is to be fabricated in such a fashion that it may be reused with minimum labor. Bolting nuts are to be protected from insulation compounds to facilitate ease in disassembly.

When the insulation is to be different from that used on the shell body, the Ordering Drawing will specify the General Specifications for Removable Shell Joint Insulation.

#### **D. Removable Covers For Valve Heads and Pipe Flanges**

The Ordering Drawing will specify where removable covers as described in Section V. B. are required. The covers are to be included as part of the Insulating Material Package. Other flange areas where removable covers are not indicated are judged to require such infrequent disassembly that use of special removable insulation is not justified.

### **III. QUOTATIONS**

The vendor submitting a quotation for heat retention material should calculate the quantities including an allowance for waste, cutting, etc., in accordance with standard practice. Type B Pipe Insulation should include as part of the order 10% additional material.

The vendor quotation should be of sufficient detail to allow those responsible for installation to readily identify the material for each individual component and the amounts to be applied.

The purchase of heat retention materials as specified on the drawings for all domestic units is the responsibility of the Power Systems Operations.

### **IV. TYPE OF INSULATING MATERIALS USED ON TURBINE SHELL AND VALVE BODIES**

#### **A. Plastic Insulation -Type A**

This is a mineral wool based material listed by various manufacturers as suitable up to 1900°F (1038°C). The mineral wool is combined with clay or other inorganic binders and rust inhibitors to give it the required plasticity when mixed with water. It is not a hydraulic setting type cement, and can be reused by breaking up the hardened material and mixing with water.

#### **B. Block Type D**

Calcium Silicate Based Material is preformed in a flat or curved form

#### **C. Thickness of Insulation Block -Type D**

The heat retention Ordering Drawing will give the hot surface temperature of the area to be insulated. It shall be the responsibility of the insulation supplier to select the proper insulation thickness to produce a maximum cold surface temperature of 140.F (60°C) with an 72.9.F (22.7°C) ambient temperature.



#### **NOTE**

Single layer when below 550°F (288°C) steam temperature. For 550°F (288°C) and above, use double layer with staggered joints. Layers to be of approximately equal thickness.

#### **NOTE**

Additional thickness of 1/2 inch to be used on areas exposed to the weather on outdoor installations.

#### **NOTE**

See Section 5.1 for Application of Insulation to Turbine Shells and Valve Bodies.

#### **D. Heat Retention Material For Steam Turbines-Calcium Silicate Block With 72.9°F (22.7°C) Ambient Temperature**



<b>METAL TEMPERATURE °F (°C)</b>	<b>MAXCOLD SURFACE °F (°C)</b>	<b>BLOCK THICKNESS</b>
1050-1000 (565.5-537.7)	122 (50)	8.0"
999-950 (537.2-510)	122 (50)	7.5"
949-900 (509.4-482.2)	122 (50)	6.5"
899-750 (481.6-398.8)	122 (50)	5.5"
749-650 (398.3-343.3)	122 (50)	4.0"
640-550 (337.7-287.7)	122 (50)	3.0"
549-450 (287.2-232.2)	122 (50)	2.5"
449-250 (231.6-121.1)	122 (50)	2.0"
250 and below (121.1 and below)	122 (50)	1.5"

<b>METAL TEMPERATURE °F (°C)</b>	<b>MAXCOLD SURFACE °F (°C)</b>	<b>BLOCK THICKNESS</b>
1050-1000 (565.5-537.7)	131 (55)	6.5"
999-950 (537.2-510)	131 (55)	5.5"
949-750 (509.4-398.8)	131 (55)	5.0"
749-650 (398.3-343.3)	131 (55)	4.0"
640-550 (337.7-287.7)	131 (55)	3.5"
549-450 (287.2-232.2)	131 (55)	3.0"
449-250 (231.6-121.1)	131 (55)	2.0"
250 and below (121.1 and below)	131 (55)	1.5"

<b>METAL TEMPERATURE °F (°C)</b>	<b>MAXCOLD SURFACE °F (°C)</b>	<b>BLOCK THICKNESS</b>
1050-1000 (565.5-537.7)	140 (60)	5.0"
999-950 (537.2-510)	140 (60)	4.5"
949-750 (509.4-398.8)	140 (60)	4.0"
749-650 (398.3-343.3)	140 (60)	3.5"
640-550 (337.7-287.7)	140 (60)	3.0"
549-450 (287.2-232.2)	140 (60)	2.5"
449-250 (231.6-121.1)	140 (60)	2.0"
250 and below (121.1 and below)	140 (60)	1.5"

**E. Block and Plastic Combination**

See Section IV. B.

**F. Finishing Cement -Type E**

This material is composed of mineral fibers and is a hydraulic setting cement used as a finishing coat (approximately 1/2 inch) over insulating cement to achieve a relatively smooth surface which can be covered with lagging fabric.

**G. Lagging Fabric -Type F**

This cloth shall be used as an outer covering for insulated piping and valve bodies.

#### **H. Adhesives -Type G**

These are used to attach lagging fabrics to insulation materials. Adhesives are preferable to sewing because of their ability to shrink the fabric tightly over the insulation.

### **V. DISCUSSION -TURBINE SHELLS AND VALVE BODIES**

Upper and lower shells (except flanges), steam valve bodies, control valve chests and exhaust casing shall be insulated with the materials noted above. Materials for horizontal and vertical flange joints will be indicated per Section II. C.

The application of block Type D Insulation should be in accordance with vendor's specifications. Application drawings on sheets 16 and 17 show the recommended method of applying turbine shell and valve insulation.

Nuts (1/2 inch - 13) are provided on the turbine shell to accommodate studs used to anchor the heat retention material.

In no case should extra nuts or any other heat retention material securing devices be welded to the turbine shell. Welding on the alloy steel shell may cause these parts to crack during operation. When valve bodies are separated from the turbine shells by long pipe runs and thus will not be covered by the metal appearance lagging, plastic insulation will be finished by the application of 1/2 inch layer of finishing cement. Type E covered by Type F lagging fabric using Type G adhesives.

#### **A. Application**

The following is a suggested method of applying Type D block insulation to turbine shells and valve bodies.

Carbon steel studs of sufficient length, provided by insulation vendor, are screwed into the nuts provided by factory, on the shell. These studs act as the securing device to which the tie wires are attached.

For valve bodies and piping the blocks in each layer are to be butted tightly together using 1/2 inch wide × 0.20 inch thick stainless steel banding on each layer, installed on 12 inch centers minimum. After the blocks are secured in place they are to be pointed with Type A plastic. Each succeeding layer is to overlap the layer below and is to be secured and pointed in the same manner.

The outer face of the insulation shall receive a scratch coat of mineral wool insulating cement, over which stainless steel chicken wire shall be stretched and securely wired in place. The surface shall be finished off with a 1/2 inch thick, when dry, coat of suitable hard finish hydraulic setting cement worked well into the chicken wire and troweled to a smooth, even surface.

On various units with shell mounted control valves, lugs have been provided on the shell and valve stand at the centerline of each lower control valve for the purpose of rigging hoists between the two in order to facilitate lowering the individual valves. The heat retention material in this area should be arranged with the necessary provisions (readily removable plug or dished) to make the lugs accessible. Refer to application drawing on Sheet 17 for a typical example of method and to the applicable shell drawing for the area involved.

**B. Removable Covers For Valve Heads, Main and Reheat Inlet Flanges, Crossover Pipe Flanges and Crossover Pipe Hinge**

The Ordering Drawing for the particular units requiring removable covers will identify the flanges requiring covers. Except for the installation of the covers, no other work is required at this assembly unless so specified on the drawing.

The removable covers are made and provided according to General Specifications for Removable In-sulated Covers, **General Specifications Heat Retention Block Material for Steam Turbine.**

**VI. TYPES OF INSULATED MATERIALS USED ON PIPING**

**A. Pre-Formed Sectional Pipe Insulation -Type B**

This is a pre-formed insulation.

**B. Thickness of Pipe Insulation -Type B**

The Ordering Drawing will give the hot surface temperature of the area to be insulated. It shall be the responsibility of the insulation supplier to select the proper insulation thickness to produce maximum cold surface temperature of 140.F (60°C) with an 72.9°F (22.7°C) ambient temperature.



Single layer insulation may be used on all pipes where steam temperature is less than 550°F(288°C). Single layer insulation may be used on all pipe sizes 2-1/2 inch and smaller regardless of steam temperature. Where steam temperature exceeds 550.F (288°C), use double layer insulation with staggered joints. Additional thickness of 1/2 inch to be used on piping exposed to the weather on outdoor installations.

**C. Aluminum Jacketing -Type J**

This is a 16 mil maximum thickness aluminum sheet metal with a protective moisture barrier liner. Available with smooth, corrugated or embossed finish.

**D. Weatherproofing Mastic -Type L**

**E. Fire Resistant Mastic -Type M (Indoor And Outdoor Use)**

**F. Finishing Cement -Type K**

The Following materials are of this type: See Section IV. F.

**G. Paint (Non-Vapor Barrier ) Type N - Indoor Use Only**

**INDOOR OR OUTDOOR USE**

## **VII. DISCUSSION -PIPING**

Main and reheat steam piping, cross under piping and all other steam piping furnished as part of the turbine unit shall be insulated with pre-formed sectional pipe insulation Type B, applied per manufacturer's recommendations. Large diameter piping, 16 inch or over, shall be insulated with flat or segmental Type D blocks with all gaps to be filled in with plastic insulating cement Type A. **PRE-FORMED SECTIONAL PIPE INSULATION IS PREFERRED.**

Pipe insulation will be finished with Type F lagging fabric using Type G adhesives. Aluminum jacketing of Type J or stainless steel may be used if requested.

Where the use of mitered block is required in insulating a large diameter pipe or irregular surface such as elbow, flanges, etc., a coating not to exceed 1/2 inch thick of Type E finishing cement shall be trowelled on before covering with lagging fabric.

Steam packing exhausters shall be insulated in the same manner as pipe.

On outdoor units all insulated parts not under the lagging or otherwise protected from weather shall be weather-proofed. For these conditions all short radius bends (less than 36 inch radius), fittings, and valve bodies shall be given a 1/2 inch coating of hard finish cement of Type K over the insulation. This will be covered according to manufacturer's recommendations with a coating of mastic Type L or M. Lagging fabric will not be used in addition to the above weatherproofing materials.

An extra 1/2 inch of insulation shall be added to all types of insulation exposed to the weather to reduce wind losses.

Aluminum pipe jacketing shall be applied to steam piping where it passes under operating oil cylinder or other devices where oil dripage may occur.

### **A. Exposed Crossover Pipes**

Special care shall be taken in insulating exposed crossover pipes not covered by metal appearance lagging.

Sheets 14 and 15 is an application drawing showing how the lifting lugs and the clamping bolts on the exposed crossover pipes are to be covered.

Some crossover pipes contain a hinge to relieve stresses caused by the difference in movement between high and low pressure turbine. The hinge should be kept free of insulation material. When removing the crossover a strong-back has to be bolted across the hinge. In order to attach the strong-back with a minimum disturbance to the insulation, a removable cover is to be installed on the crossover.

After the insulation has been installed, level the insulation with insulating cement and make joints tight to insure a uniform surface. Apply a blending coat of sealer to the insulation prior to wrapping with lagging fabric. Aluminum jacketing may also be used.

Apply a uniform brush coat of a manufacturer recommended sealing fastener on all longitudinal and butt joint laps of lagging fabric. Immediately bond laps of lagging fabric. Pull fabric tight and smooth out to avoid wrinkles and gaps.

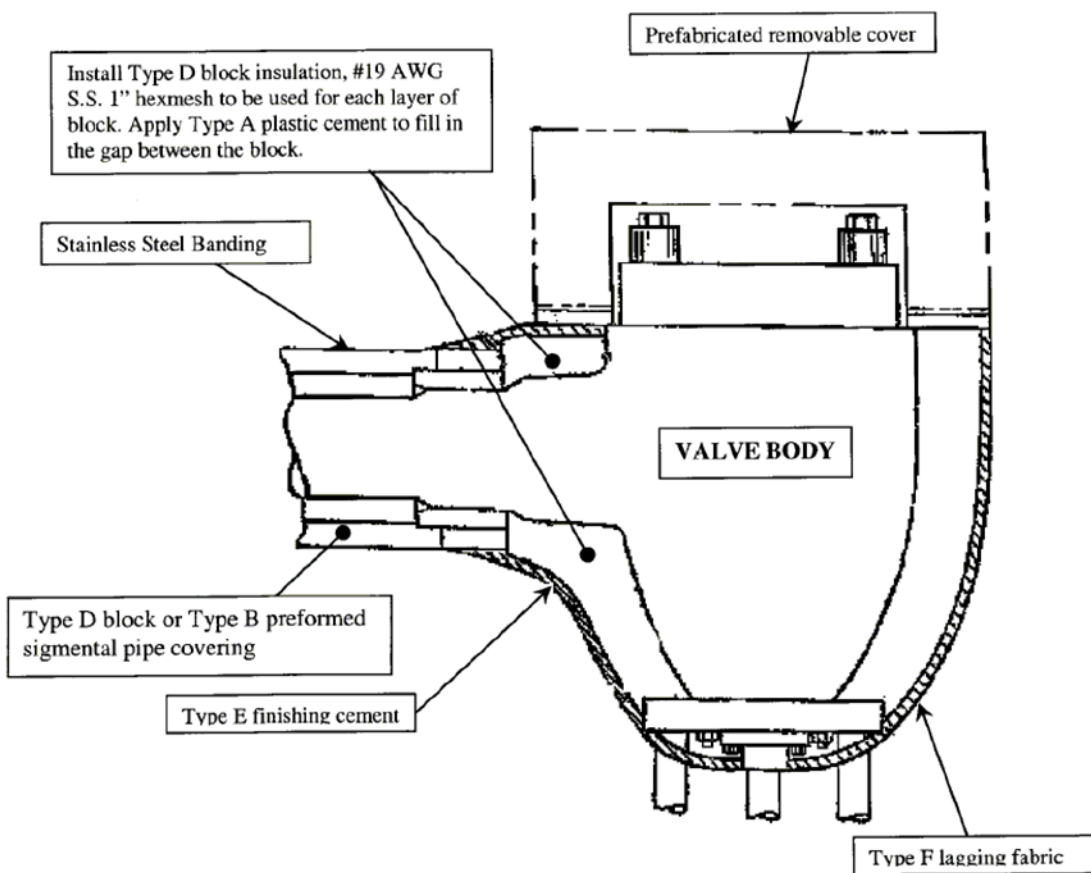
Immediately apply a uniform coating of a manufacturer recommended sealing fastener to the entire surface at the rate of 70 sq ft per gallon.

Where the pipeline is outdoors and exposed to the weather, allow 24 hrs drying time, then apply to the entire surface, two uniform coats of vinyl coating (color as selected) at the rate of 150 to 200 sq ft per gallon per coat. Allow a minimum of 4 hours drying time between coats. For indoor use see Section VI. G.

**B. Exposed Steam Piping**

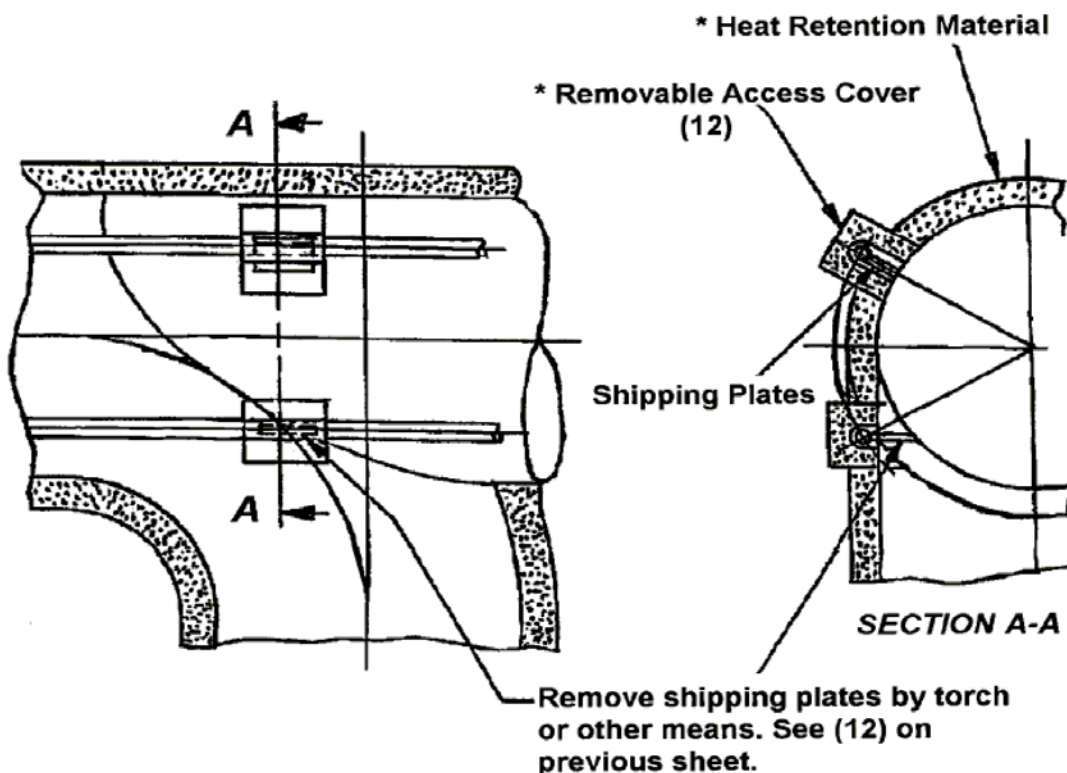
Exposed steam leads not covered by metal lagging above the operating floor, shall be finished in the same manner as described for Exposed Crossover Pipes(Section VII. A.), to achieve a satisfactory ap-pearance. Expansion joints shall be included in the pipe covering above the operating floor to prevent cracking in the outer layer and scorching the painted lagging fabric.

**VIII. DRAWINGS**

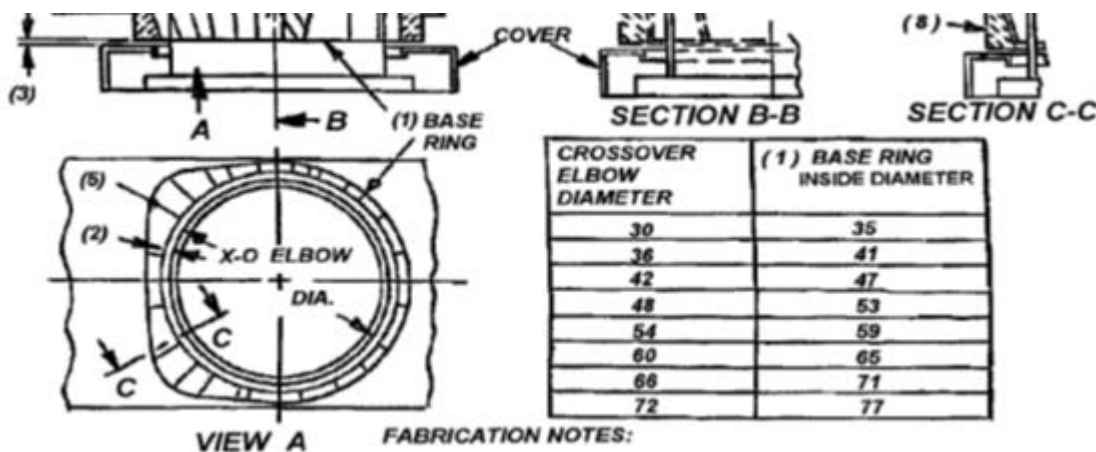


**APPLICATION OF TYPE A PLASTIC AND/OR TYPE D  
BLOCK INSULATION TO TYPICAL TURBINE VALVE**

**\*All insulation material is supplied by the Insulation Supplier/Vendor  
\*All insulation material is to be installed by the Site Insulation Contractor**



\* MATERIAL SUPPLIED BY INSULATION CONTRACTOR



Material referred to is supplied by vendor.

(1) (4) (5) Insulation support frame with Base Ring of required diameter (see Table) 1/4 X 1/2 bar or 1/2 dia. Concrete reinforcing rod to allow 2 - 1/2 minimum.

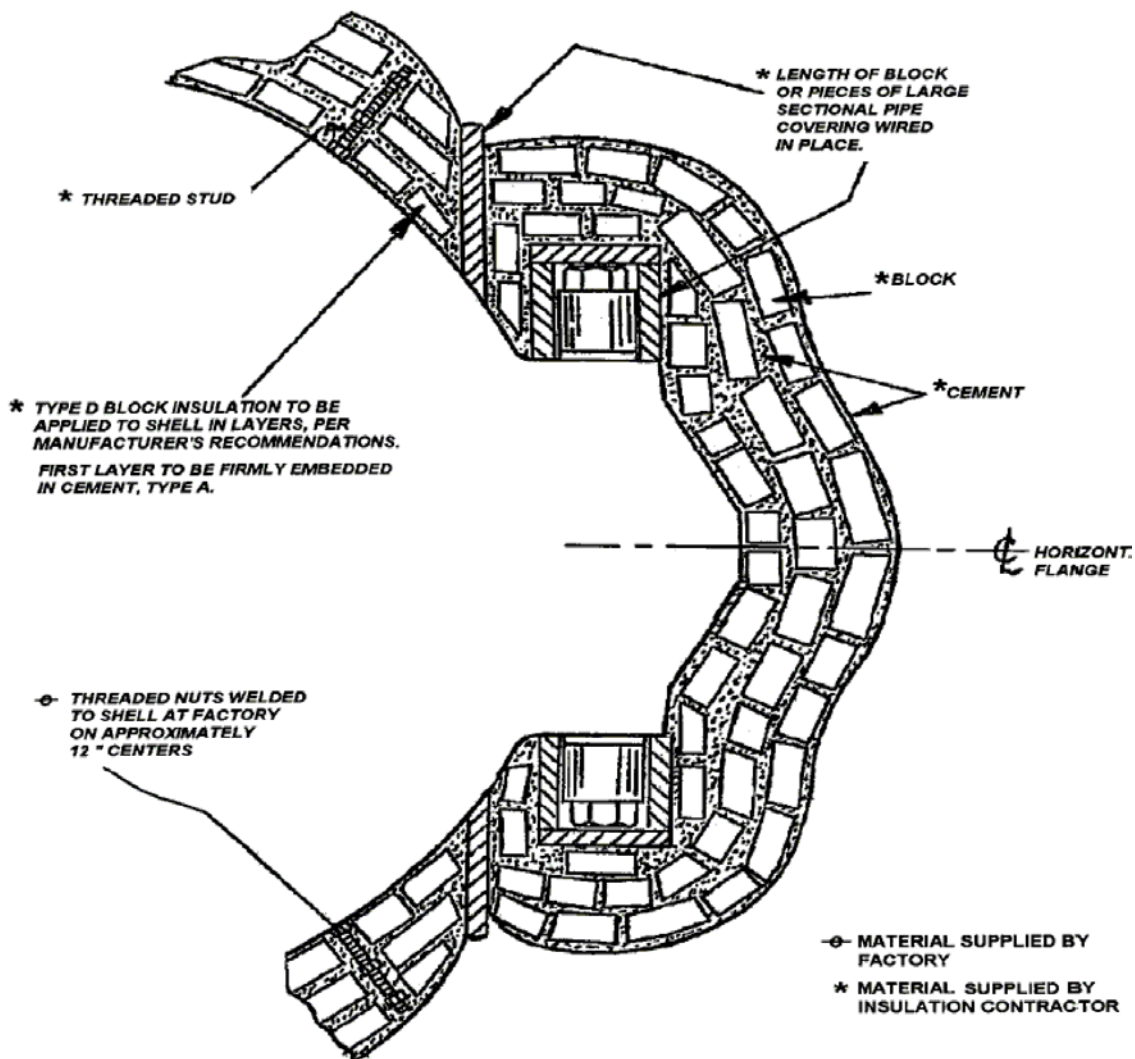
(2) clearance from elbow and a 1/4 min. (3) clearance from crossover flange cover.

(4) Upright and cross members of sufficient quantity to adequately support wire fabric and insulation.

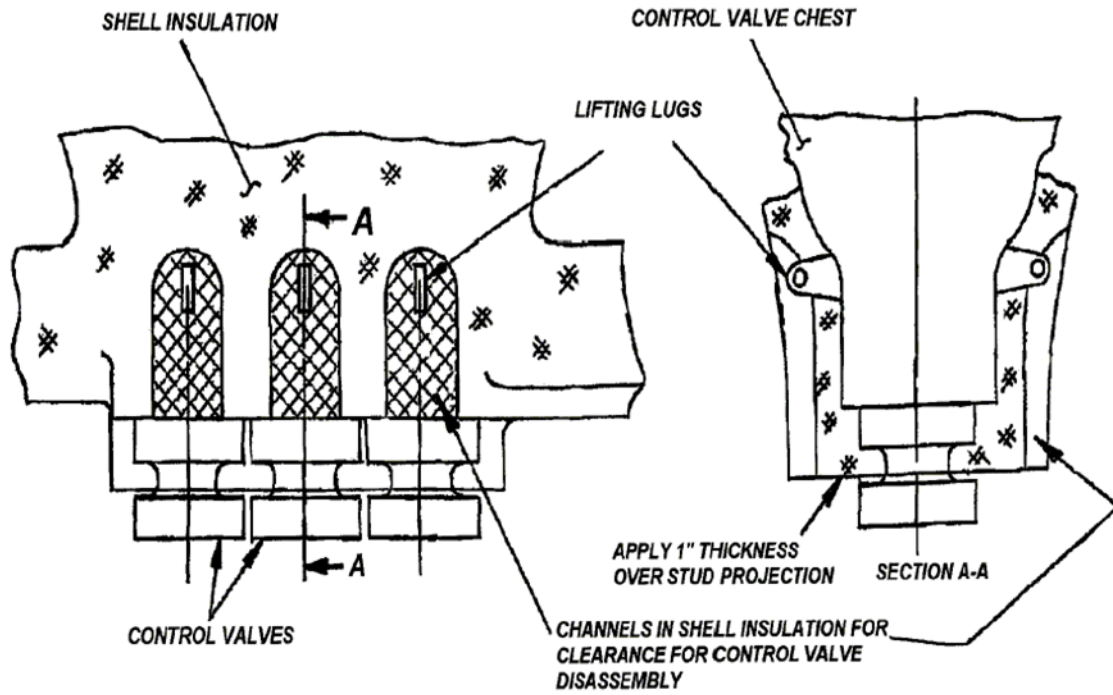
(8) Thickness of insulation may vary to result in round and vertical column around supporting frame.

(9) (10) (11) Locking bolt pads, jacking device and lifting lugs to be provided with removable plug of insulation and metal cover.

(12) 10 X 8 access cover-after cross-over has been assembled to turbine, remove shipping plates (4) by torch or other means. The access cover should be located in the same area. Re-lock tie rods to tee by welding or other means before cross-over is be disassembled from turbine.



APPLICATION OF ALL BLOCK TYPE INSULATION  
 ON TURBINE SHELL & HORIZONTAL FLANGE



APPLICATION OF INSULATION AT AREA  
OF LOWER CONTROL VALVE CHEST  
LIFTING LUGS

## **2.0 General Specifications Removable Insulated Covers For Steam Turbines**

### **I. INTRODUCTION**

This specification applies to removable insulated covers for main and reheat flanges, all main and reheat valve heads, crossover flanges, hinge covers, cross-unders and cross-arounds where required by design.

The covers are to be fabricated in accordance with the following specifications. All materials shall be asbestos-free.

It shall be the responsibility of the cover manufacturer, or insulation supplier, to produce the necessary detail drawings to manufacture covers in accordance with this specification.

Use of material other than specified must be referred to the Schenectady Turbine-Generator Marking Operation for approval through usual District Office procedures.

### **II. TYPES OF COVER INSULATING MATERIALS**

#### **A. Block Type D**

##### **Description**

This is a pre-formed material in flat or curved block form.

#### **B. Blanket Insulation**

##### **Description**

These are high temperature blanket pads which contain a filler composed of one (1) or more layers of a spun refractory fiber of approximately eight (8) lbs density, made to conform to the inner contour of the cover.

### **III. COVER CONSTRUCTION**

#### **A. Materials**

All insulated covers will be constructed of #16 gage minimum stainless steel type 302, 304, or 430 with one exception; the exception applying to parting flange covers for crossover pipes. These may be carbon steel [Supplier's option] due to the lower temperature involved.

#### **B. Insulating Materials**

Blanket insulation (Section II. B.) may be used. Methods of holding will be as recommended for block type insulation. The use of studs and stud welder, expanded metal lath or stainless steel knitted wire mesh, is also permitted for holding the blankets to the inside of the covers.


#### **C. Discussion**

Cover parts are to be joined by a one eighth (1/8 inch) continuous fillet weld, provided the weld is not exposed to view.

Covers may be split into several sections to facilitate assembly and removal. They will be braced as

necessary for sturdy construction with no bracing or anchors protruding through the insulation to any hot surface. Lifting devices will be provided and will be covered by inserts of insulating material.

When covers are split to accommodate removable pipes or valve linkage, the split must be faced on both sides with the same materials as the cover.

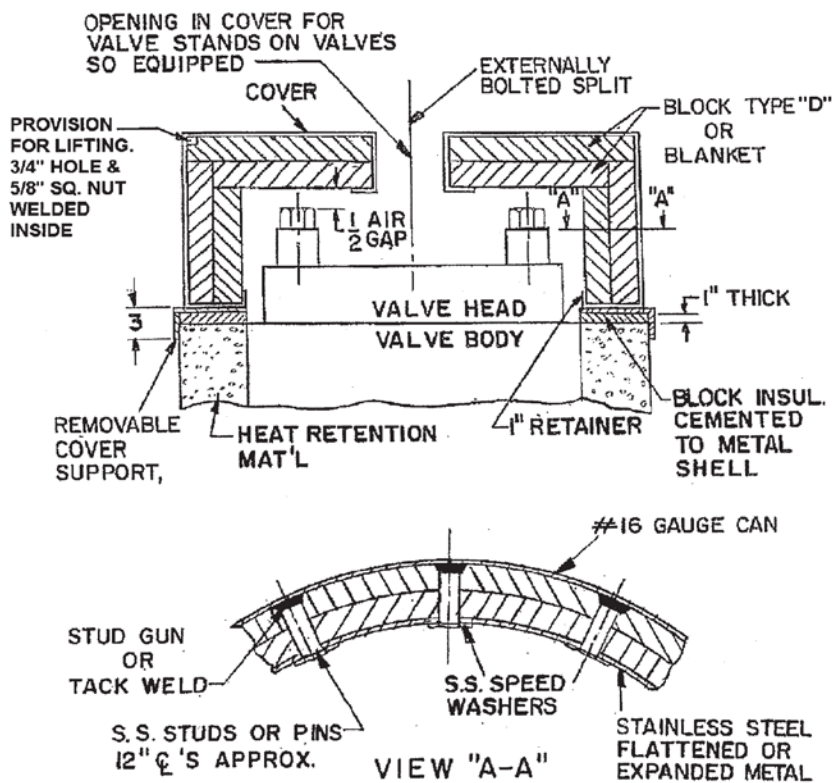
The allowable cover surface temperature will not exceed 135°F at an ambient of 72.9°F(22.7°C) under turbine operating conditions of 100%. | 

A typical cross section of cover construction is shown on sheet 4.

**D. Shipment Of Fabricated Covers**

Covers manufactured for foreign shipment are to be packaged in accordance with shipping instructions provided by Power Systems Sourcing Operations (PSSO) or its representative.

Covers for domestic units will be packaged and shipped according to instructions provided by Power Systems Sourcing Operations (PSSO).



**TYPICAL REMOVABLE & REUSABLE COVER**

### **3.0 General Specifications Removable Blanket Insulation for Steam Turbines**

#### **I. INTRODUCTION**

This specification applies to turbine shell blankets supplied by the Power Systems Sourcing Operations, PSSO. They will be Tailor-Made removable insulation and be of such quality as to have long life, provided reasonable care is used in handling. The maximum weight of a blanket pad is to be approximately 80 lbs.

Use of material other than specified must be approved by the Schenectady Turbine-Generator Factory PSSO. All materials shall be ASBESTOS-FREE.

#### **II. HIGH TEMPERATURE BLANKETS**

The high temperature blankets are for use as the first layer next to the turbine shell where the metal temperature will be 650°F or above.

##### **A. HEAT RETENTION FILLER - HIGH TEMPERATURE**

The high temperature blanket pads are to contain a filler composed of one or more layers of a spun refractory fiber of approximately 8 lbs/ft<sup>3</sup> density made in blanket form. The blanket is to be of such thickness that the temperature between the high and low temperature pads is below 650°F.

The heat retention material drawings will give the hot surface temperature of the areas to be insulated. The thickness in Section II. B. are used in design to provide sufficient clearance around power plant equipment and turbine metal lagging.

##### **B. THICKNESS OF BLANKET WITH 72.9°F(22.7°C) AMBIENT TEMPERATURE**



<b>METAL TEMPERATURE °F (°C)</b>	<b>MAX COLD SURFACE °F (°C)</b>	<b>*BLANKET THICKNESS</b>
1050-1000 (565.5-537.7)	122 (50)	7.0" DL
999-950 (537.2-510)	122 (50)	6.5" DL
949-900 (509.4-482.2)	122 (50)	6.0" DL
899-650 (481.6-343.3)	122 (50)	5.0" DL
649-600 (342.7-315.5)	122 (50)	4.0" DL
599-501 (315-260.5)	122 (50)	3.5" DL
500 and below (260 and below)	122 (50)	3.0" DL

<b>METAL TEMPERATURE °F (°C)</b>	<b>MAX COLD SURFACE °F (°C)</b>	<b>*BLANKET THICKNESS</b>
1050-1000 (565.5-537.7)	131 (55)	6.0" DL
999-950 (537.2-510)	131 (55)	5.5" DL
949-900 (509.4-482.2)	131 (55)	5.0" DL
899-650 (481.6-343.3)	131 (55)	4.5" DL
649-600 (342.7-315.5)	131 (55)	4.0" DL
599-501 (315-260.5)	131 (55)	3.0" DL
500 and below (260 and below)	131 (55)	2.5" DL

<b>METAL TEMPERATURE °F (°C)</b>	<b>MAX COLD SURFACE °F (°C)</b>	<b>*BLANKET THICKNESS</b>
1050-1000 (565.5-537.7)	140 (60)	5.0" DL
999-950 (537.2-510)	140 (60)	4.5" DL
949-900 (509.4-482.2)	140 (60)	4.0" DL
899-650 (481.6-343.3)	140 (60)	4.0" DL
649-600 (342.7-315.5)	140 (60)	3.5" DL
599-501 (315-260.5)	140 (60)	3.0" DL
500 and below (260 and below)	140 (60)	2.5" DL

**\*DL = Double Layer - Blanket system must be manufactured with a high temperature blanket and a low temperature blanket.**

**C. MATERIALS - HIGH TEMPERATURE**

**D. ENVELOPE - HIGH TEMPERATURE**

The heat retention filler is to be enclosed in an envelope of inconel knitted wire mesh. The envelope shall consist of knitted wire mesh on both sides. The envelope will be sewn together with fiberglass coated stainless steel thread or with flange seams stapled together with stainless steel staples. Approved knitted wire mesh is .011 diameter wire, 5 to 7 courses per inch.

**E. LOW TEMPERATURE BLANKETS**

The low temperature blankets are for use where the temperature is below 500°F.

**F. HEAT RETENTION FILLER -LOW TEMPERATURE**

The low temperature blankets are to contain a filler composed of one or more layers in blanket form. The material is to be approximately 9 lbs/ft3 density. The blanket is to be of a thickness that will give a cold surface temperature of 140°F(60°C) MAXIMUM WITH AN 72.9°F(22.7°C) AMBIENT. UNLESS OTHERWISE SPECIFIED ON ORDERING DRAWING.



**NOTE**

Use only one type filler material throughout the temperature range.

**G. MATERIALS - LOW TEMPERATURE**

**H. ENVELOPE - LOW TEMPERATURE**

The heat retention material filler is to be enclosed in an envelope. Lagging fabric is required on the hot face. The cold face will consist of a silicone impregnated fiberglass cloth or equivalent. The envelope will be sewn together with fiberglass coated stainless steel thread or with flange seams stapled together with stainless steel staples.

**J. TUFTING AND SECUREMENT**

The completed high and low temperature blankets will be tufted where necessary to prevent slippage between layers of filler and to provide a uniform applied density of approximately 10 lbs/ft3.

The completed high and low temperature blankets will be provided with suitable hooks at frequent intervals along the blanket pads for wiring them to the turbine shell and to other pads. The blankets

will be reinforced at the hooks to prevent damage to the outer covering.

### **III. STEAM TURBINE GENERAL INSTALLATION INSTRUCTIONS - FIT OF BLANKETS**

#### **A. Objective**

The purpose of this document is to assist the contractor through the installation process. Extreme care and supervision is recommended to ensure proper application and coverage of the materials.

#### **B. Inventory of Materials**

All materials are to be stored in a dry environment. Check the materials received in accordance with the packing list provided by the Supplier. Contractor shall identify the number of cartons\skids supplied compared to the packing list. Contact the Supplier immediately if any discrepancies occur.

#### **C. Identification of Materials**

Contractor shall identify where all materials are to be installed using the following guidelines:

- Removable blankets on turbine shells, (check blanket items comparing them to the packing list).
- Removable stainless steel covers\removable insulation blankets on valve heads and crossover flanges
- Accessory items (studs with nails and washers, welding pins, etc.)
- Modification kit and tools (includes insulation, fabric, mesh, etc.)

The blankets should be delivered 100% fabricate. The contractor that will install the insulation system should be able to provide necessary (field) fitting work. For example:

- Adjustment of the blankets at the bearing cover/pedestal to maintain at least 1" air gap between the insulation cold face and pedestal;
- Area around borescope openings;
- Area around balance access Covers,
- Connections between pipe insulation and turbinw blankets,
- Modification of blankets to suit condition

The total amount of the blanket modification might be up to 5% of the total scope depending on the contractors experience and judgment.

Our insulation package includes modification kit with all necessary material and hardware to provide necessary fitting work.

### **IV. INSTALLATION DRAWINGS FOR TURBINE**

Drawings include the tag numbers, location, application details, and installation methods.

Drawings include proper size and thickness for steam pipes, valve body, crossover pipe, and gland steam condenser.

## **V. INSTALLATION OF REMOVABLE BLANKETS ON STEAM TURBINE**

### **A. Inner Layer Lower Half Blankets**

1. Prepare scaffolding for the lower half and the horizontal joint.
2. Layout all lower half blankets along the grating or floor of left and right sides of the machine. Follow drawing layout legend for tagging information.
3. Install 1/2" x 9" threaded stud with nail into the threaded nut on the turbine casing. See detail drawing for removable blankets.
4. Install studs in order to prevent air gaps or sagging of blankets. Quantity shall be at the discretion of the installing contractor.
5. Install loose cerawool insulation between and behind joint bolts. See photos 1 and 2.
6. Install 1/2" to 1" cerawool around the horizontal joint bolts. See photos 3 and 4.
7. Inner layer of the blanket system shall be installed in accordance with the assembly sequence on installation drawing. Install washer onto each nail temporarily, on each blanket. When all of the blankets line up properly, secure washers firmly and snug the Blankets to the casing. See photos 5 and 6.
8. If small gaps occur, stuff them with scrap ceramic wool and secure with 16 gauge stainless steel tie wire.
9. Using the same studs on the outer layer, install the second layer of blankets the same way as on the first layer.

### **B. Inner Layer Upper Half Blankets**

1. Layout all upper half blankets along the grating or floor of left and right sides of the machine. Follow drawing layout legend for tagging information.
2. Install 1/2" x 9" threaded stud with nail into the threaded nut on the turbine casing. See detail drawing for removable blankets.
3. Install loose cerawool insulation between and behind joint bolts. See photo 2.
4. Install 1" cerawool around the horizontal joint bolts. See photos 3 and 4.
5. Inner layer of the blanket system shall be installed in accordance with the assembly sequence on detail drawing. Install washer onto each nail temporarily, on each blanket. When all of the blankets line up properly, secure washers firmly and snug the blankets to the casing.
6. If small gaps occur, stuff them with scrap ceramic wool and secure with 16 gauge stainless steel tie wire.

7. Make sure all blankets are installed without any gaps and secured firmly onto the turbine casing.
8. See photo 7.
9. Outer layer blankets shall not be installed at this time.

**C. Inner Layer Horizontal Joint Blankets**

1. Layout all joint blankets along the grating or floor of left and right sides of the machine. Follow drawing layout legend for tagging information.
2. Install 1/2"x 9" threaded stud with nail (one stud on 12"- 18" centers) into the threaded nut on the turbine casing. See detail drawing for removable blankets.
3. Inner layer of the blanket system shall be installed in accordance with the assembly sequence on installation drawings. Install washer onto each nail temporarily, on each blanket. When all of the blankets line up properly, secure washers firmly and snug the blankets to the casing.
4. See photos 8, 9, and 12.

**D. Outer Layer Of Lower Half Blankets**

1. Outer layer of the blanket system shall be installed in accordance with the assembly sequence on installation drawing. Install washer onto each nail temporarily, on each blanket. When all of the blankets line up properly, secure washers firmly and snug the insulation to the inner layer.
2. If small gaps occur, stuff them with scrap ceramic wool and secure with 16 gauge stainless steel tie wire.
3. Make sure all blankets are installed without any gaps and secured firmly next to the turbine casing or inner layer.

**E. Outer Layer Of Upper Half Blankets**

1. Outer layer of the blanket system shall be install in accordance with the assembly sequence on detail drawing. Install washer onto the nail temporarily on each blanket. When all of the blankets line up properly, secure washers firmly and snug the insulation to the casing.
2. If small gaps occur, stuff them with scrap ceramic wool and secure with 16 gauge stainless steel tie wire.
3. Make sure all blankets are installed without any gaps and secured firmly next to the inner layer.

4. See photos 10 and 11.

**F. Outer Layer Of Horizontal Joint Blankets**

1. Outer layer of the blanket system shall be installed in accordance with the assembly sequence on installation drawing. Install washer onto each nail temporarily, on each blanket. When all of the blankets line up properly, secure washers firmly and snug the insulation to the inner layer. See photo 13.
2. If small gaps occur, stuff them with scrap ceramic wool and secure with 16 gauge stainless steel tie wire.
3. Make sure all blankets are installed without any gaps and secured firmly next to the inner layer.

**G. Installation Procedure in Bearing Area or Packing Casing**

Insulation blankets in the area between the turbine rear and front bearing housing should be installed with an air gap of at least 1-1/2". **IMPORTANT!** See photos 12 and 13.

**H. Installation of Removable Acoustical Blankets on Exhaust Hood**

1. Inventory of Materials
2. All materials are to be stored in a dry environment. Check the materials received in accordance with the packing list provided by the Supplier. Contractor shall identify the numbers of cartons/skids, blankets, accessory items including the items in the modification kit.
3. Installation of Removable Blankets
4. Layout all blankets along the floor to the left and right sides of the hood. Follow drawing layout legend for tagging information.
5. Weld pins to the exhaust hood, not less than four per blanket.
6. Blankets shall be installed in accordance with the assembly sequence on the installation drawings. Install a washer onto each pin temporarily, on each blanket. When all of the blankets line up properly, secure washers firmly and lace with 16 gauge stainless steel wire.

#### **4.0 Reference Drawings**

- HEAT RETENTION MATERIAL FOR MAIN STEAM PIPES (MD1-0-V-111-11-00005, SHT. NO. 2)
- HEAT RETENTION MATERIAL FOR M.S&C.V (MD1-0-V-111-11-00005, SHT. NO. 3)
- HEAT RETENTION MATERIAL FOR C.R.V (MD1-0-V-111-11-00005, SHT. NO. 4)
- HEAT RETENTION MATERIAL FOR VALVES&SPE (MD1-0-V-111-11-00005, SHT. NO. 5)
- HEAT RETENTION MATERIAL HIP&X-OVER PIPE (MD1-0-V-111-11-00005, SHT. NO. 6~7)
- HEAT RETENTION MATERIAL FOR STEAM PIPES (MD1-0-V-111-11-00005, SHT. NO. 8~12)



#### **5.0 Appendix Photo**



**Photo 1 - Bottom part of the horizontal joint of the turbine. Stuffing insulation (scrap) between and behind nuts.**



**Photo 2 - Top portion of the horizontal joint of the turbines. (Stuffing of the insulation.)**



**Photo 3 - Bottom portion of the horizontal joint. (Cold reheat part of the turbine with nuts covered.)**



**Photo 4 - Horizontal joints covered with required loose mat insulation (1/2 inch thickness).**



**Photo 5 - Bottom of the turbine. Intersection of the main steam inlet and hot reheat with inner layer blankets only. Quantity of studs with nails for the bottom of the turbine should be determined to prevent sagging of blankets. Blankets shall be installed without any gaps.**



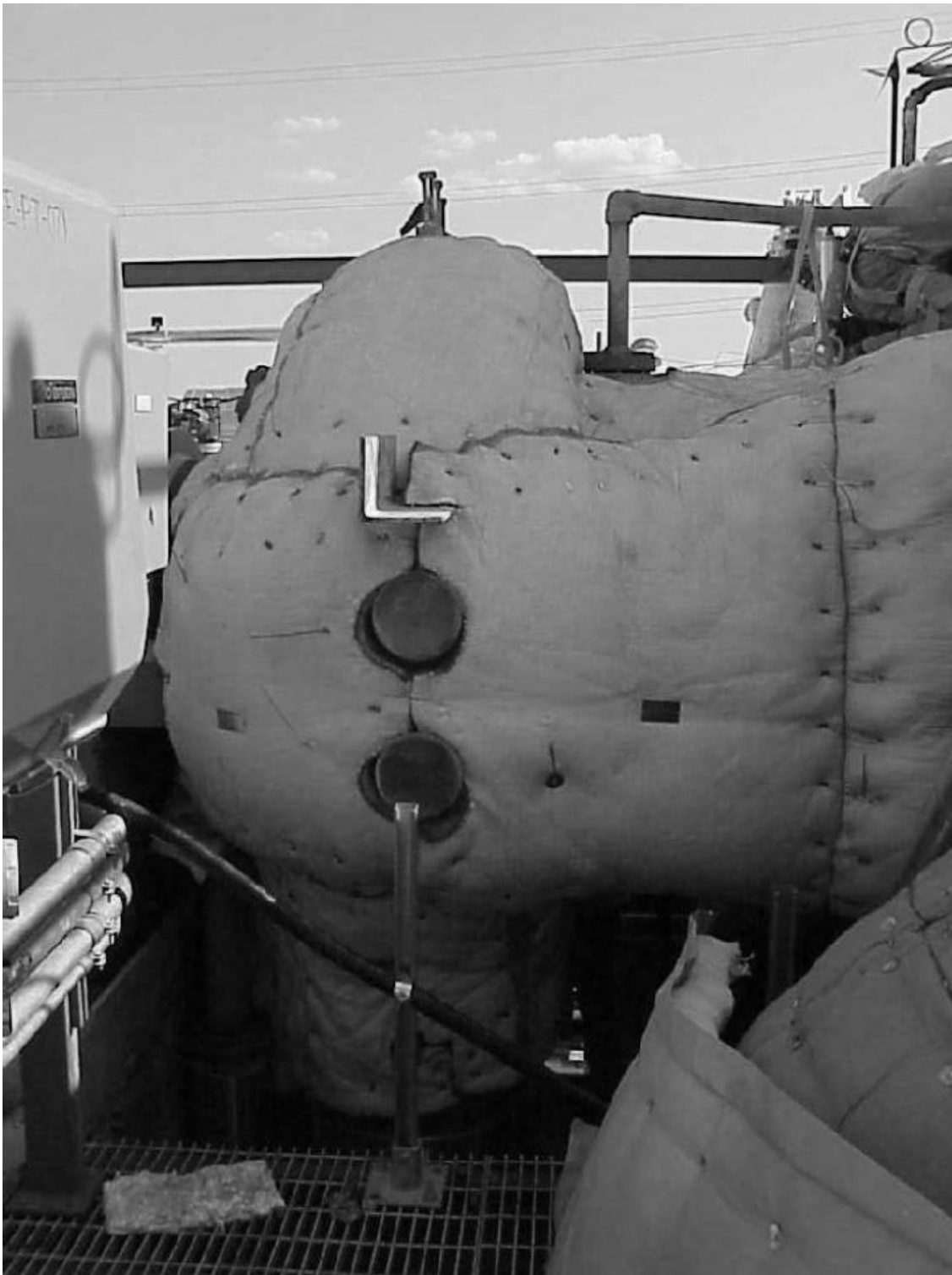
**Photo 6 - Bottom of the turbine. Intersection of the main steam inlet and hot reheat shall be covered with 1/4 inch to 1/2 inch thickness of insulation before installation of inner layer.**



**Photo 7 - Top front view of the turbine with inner layer blankets installed.**



**Photo 8 - View of the back side turbine with inner layer blankets installed.**



**Photo 9 - View of the right side turbine with inner layer installed.**



**Photo 10 - View of the turbine with outer layer blankets installed. Installation of the removable metal cover for HP/IP crossover. Borescope opening has not yet been covered with blanket installation.**



**Photo 11 - Back side of the turbine with assembled removable blankets at crossover connection.**

**Insulation blanket in the area between the turbine and front bearing housing should be installed with an air gap of at least 1.1/2 inches.**



**Photo 12 - View of the front bearing housing with inner layer blankets installed.**

**Insulation blanket in the area between the turbine and front bearing housing should be installed with an air gap of at least 1-1/2 inches.**



**Photo 13 - View of the air gap between front bearing housing and turbine blankets.**