



NATIONAL PETROCHEMICAL COMPANY
STANDARDS

CONSTRUCTION STANDARD
FOR
EXTERNAL INSULATION

NPCS-CS-TP-07

REVISION : 0

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1 SCOPE

- 1.1 This standard covers minimum requirements for above ground, external insulation of piping and equipment operating between ambient temperature and 550°C for the purpose of heat conservation, process stabilisation, temperature maintenance, personnel protection and fire protection.

2 GENERAL

- 2.1 This standard does not cover insulation for boiler or fired heaters and associated air heaters, economisers, flue ducting and air ducting.

- 2.2 Piping, equipment, storage tanks and vessels requiring insulation shall normally be specified on the following project documents.

- a) Process and Instrument Diagrams (P&IDs).
- b) Piping Plans & Isometrics.
- c) Instrument Piping Details and Schedules.
- d) Vessel, Exchanger, Storage Tank and sphere documents and Insulation Schedules.
- e) Equipment supplier's General Arrangement Drawings for equipment items in package plant.

- 2.3 The thickness of insulation given is the nominal thickness of the basic insulating medium.

- 2.4 Definition of terms used in this standard shall be in accordance with ASTM Standard C168. All ASTM Specification referred to shall be of latest edition.

- 2.5 Insulation is required for any of the following purposes, as will be indicated in P&IDs and line lists:

- Heat conservation (H)

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- Process stabilisation to assist process control.

a) Tracing

I) Steam tracing. (S)

II) Electric tracing. (E)

III) Hot water or solvent tracing (L)
(liquid)

IV) Hot oil tracing. (O)

b) Jacketing

I) Steam jacketing. (JS)

II) Hot water or liquid jacketing. (JL)

III) Hot oil jacketing. (JO)

- Fire hazard protection to prevent fast boil off of liquid. (F)

- Personnel protection (P)

Personnel protection is applicable where exposed surface temperatures exceeds 65°C in normal or short-term operating conditions, over internally insulated piping and equipment where personnel protection is required, but insulation is not permitted, provide open mesh metal guards and for surfaces which are not internally insulated, provide insulation on that part of surfaces with which operating and maintenance personnel may come in contact while performing routine duties. The intent of P&IDs, line classification lists, Engineering drawings, etc., which designate insulation for personnel protection is to call attention only to the eligibility of such service. The actual extent of insulation shall be determined by Field Construction Personnel and/or operating personnel using the following criteria: Exposed surfaces operating above 65°C and located within 1000 mm horizontally or 2100 mm vertically of a normal access, walkway or work area.

Valves, flanges and unions shall not be insulated for personnel protection.



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- 2.6 Instruments and associated piping subject to operating flow and/or temperature conditions prevailing in the connected piping or equipment shall be insulated to the same requirements as that of piping or equipment.
- 2.7 Hydrostatic tests on pipes, vessels and equipment shall, if possible be completed before insulation is installed. If insulation is applied before testing, all welds and threads shall be left exposed until completion of testing.
- 2.8 Care shall be taken to avoid contact between dissimilar material which might cause galvanic corrosion.
- 2.9 Inspection openings shall be provided in the insulation at locations to be selected at site by purchaser. The removable window shall be of the same basic material and thickness as the rest of the insulation and of sufficient rigidity to withstand handling.
- 2.10 Insulation which needs to be removed for maintenance purposes shall be fabricated in such a manner, that it is easily removable and can be remounted with a minimum of work. Quick opening boxes and similar construction shall be used in that case.
- 2.11 Piping which is traced shall be covered with oversized pipe insulation to include the tracer lines. Union and tracer line loops shall be separately insulated. Oversized pipe insulation shall be in accordance with the following schedule (TABLE 2.11).



NOMINAL SIZE OF PREFORMED PIPING SECTIONS
INSULATION MATERIAL
OVER TRACED PIPING
TABLE 2.11

PIPE SIZE (INCH)	1/2" TRACER NOS.	
	ONE TRACER	TWO OR THREE TRACERS
1/2	1 1/4	1 1/4
3/4	1 1/4	1 1/2
1	1 1/2	2
1 1/2	2 1/2	2 1/2
2	3	3
3	3 1/2	4
4	5	5
6	7	7
8	9	9
10	11	11
12	14	14
14" & LARGER NEXT SIZE UP ON SCHEDULE.		

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2.12 Single thickness sectional pipe insulation shall be applied with longitudinal joints staggered and shall be secured with wire ties on 230 mm centers.

Double thickness sectional pipe insulations shall be applied with all joints staggered and shall have inner layer secured by at least two wires per section with the outer layer secured by wire ties on 230 mm centers.

2.13 External stiffening rings on the vessel and piping shall be insulated with the same thickness as required for the vessel or piping.

3 EXTENT OF INSULATION

3.1 ON PIPING

3.1.1 Insulated piping systems shall have straight pipe, bends, tees and pipe fittings completely insulated.

3.1.2 All valves and flanged joints shall be completely insulated only in steam, condensate service, hot oil lines and in lines which are trace heated or jacketed to maintain temperatures.

3.1.3 For bucket and float type traps the inlet piping and trap shall be insulated.

3.1.4 Insulation on inlet piping to thermostatic and thermodynamic steam traps shall terminate at approximately 500mm before the trap.

3.1.5 Steam trap outlet piping other than closed condensate recovery system shall not be insulated except for personnel protection reasons.

3.1.6 Instrumentation to be insulated, such as level gauges, level controllers, level switches, dp cells, shall have their fluid containing sections and the associated piping completely insulated, including pipes, valves and fittings.

3.1.7 Insulation shall not be applied to the following, unless otherwise specified.



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- 3.1.7.1 Piping which becomes hot intermittently, such as relief valves, vents, steam-out and snuffing steam systems, flare and blowdown systems.
- 3.1.7.2 Supports for piping, excluding pipe hangers to the extent covered by insulation.
- 3.1.7.3 Steam Traps (except as noted in Clause 3.1.3).
- 3.1.7.4 Valves, including control valves and flanges in process piping systems (except as noted in Clauses 3.1.2 and 3.1.6). However, personnel protection insulation for these items shall be applied, as required.
- 3.1.7.5 Pipe Union fittings.
- 3.1.7.6 Thermowell bosses and pressure tapplings.
- 3.1.7.7 Expansion joints, hinged joints and hose assemblies.
- 3.1.7.8 Sight flow indicators.
- 3.2 ON EQUIPMENT
 - 3.2.1 Support skirts of insulated vertical vessel greater than 900 mm diameter shall be insulated both internally and externally for a minimum distance of 600 mm below the bottom tangent line. The insulation shall terminate not less than 300mm above the support concrete or steelwork.
 - 3.2.2 Support skirts of insulated vertical vessels of 900 mm and less shall be insulated externally only, as described in Clause 3.2.1 above.
 - 3.2.3 Insulation shall not be applied to the following unless otherwise specified.
 - 3.2.3.1 Pumps with operating temperature below 200°C unless pumped fluid has a pour point above minimum design ambient temperature.
 - 3.2.3.2 Fans, compressors, blowers or other rotating or reciprocating equipment.
 - 3.2.3.3 Liquid ends of pumps except as noted in Clause 3.2.3.1 above.
 - 3.2.3.4 Internally insulated or refractory lined equipment unless specially designed for metal temperature control.



- 3.2.3.5 Heads of vessels enclosed by support skirts with vessel diameters 900 mm and less.
- 3.2.3.6 Internal surfaces of insulated vessel support skirts with vessel diameter 900mm or less.
- 3.2.3.7 Turbine casings to be insulated shall exclude shaft seal caps, shaft bearing housings, throttle valves, governors and supports.
- 3.2.3.8 Exchanger channel and covers; shell and channel flanges, & Exp. Joints.
- 3.2.3.9 Nozzles, manholes and handholes and flanges of equipment.
- 3.2.3.10 Surfaces of coolers and condensers.
- 3.2.3.11 Nameplates of all equipment items.
- 3.2.3.12 Thermowell bosses and pressure tappings.

4 MATERIALS

4.1 INSULATION MATERIAL

ASTM C-547
Class 2 & 3

Pipe Insulation Mineral
Fiber Performed.

ASTM C-592'
CLASS II

Mineral Fiber
Blanket Insulation &
Blanket Type Pipe
Insulation (Metal Mesh
Covered).

ASTM C-612
Class 3,4 & 5

Mineral Fiber Block
& Board Thermal
Insulation

ASTM C-553
Class B-4

Mineral Fiber Blanket
(for Expansion Joint
only).

ASTM C-533
Type I & II

Calcium Silicate.



ASTM C-552 Type I
Through IV

Cellular Glass Block
and Pipe Thermal
Insulation.

ASTM C-195

Mineral Fiber Insulating
cement ,

ASTM C-449

Mineral Fiber Insulating
and Finishing Cement
(Hydraulic Setting).

4.2 WEATHERPROTECTION JACKET

4.2.1 Aluminium jacketing shall be used as weatherprotection over insulation unless otherwise specified and shall be as per ASTM B209 alloy 3003 H16 or approved equal, with factory applied polykraft vapor barrier and supplied as follows:

4.2.1.1 0.50 mm (0.020") thick smooth sheeting for piping.

4.2.1.2 0.80 mm (0.031") thick smooth sheeting for vessel and equipment 760 mm diameter and smaller.

4.2.1.3 0.80 mm (0.031") thick x 32 mm (1 1/4") corrugated for vessels and equipment larger than 760 mm diameter.

4.2.1.4 0.50 mm (0.020") thick x flat for vessels, equipment headsand transitions.

4.3 ANCILLARY MATERIALS

4.3.1 Aluminium foil to Protect Stainless Steel Surfaces shall be 0.19 mm thick.

4.3.2 Securement Bands and Wires

4.3.2.1 For securing Aluminium foil on stainless steel surfaces, band 24 SWG thick X 19 mm wide Aluminium, shall be used.

4.3.2.2 For securing insulation, shall be type 304 Stainless Steel:

a. 13 x 0.5 mm for vessels, exchangers, storage tanks, spheres and piping up to 1500 mm in diameter.

b. 19 x 0.5 mm for vessels, exchangers, storage tanks, spheres and piping over 1500 mm in diameter.

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- 4.3.2.3 Tie wire shall be annealed type 304 Stainless Steel to secure insulation, wire gages shall be as follows:
- Pipe 12" DIA. & under : 16 (1.5mm).
- Vessels and pipe over 12" : 14 (2.0mm).
- 4.3.3 Wire mesh and expanded metal lath shall be monel, 20 gage, 25 mm hexagonal mesh to 800°F and type 304 Stainless Steel above 800°F.
- 4.3.4 "Z" clips shall be : 19 x 0.5 mm type 304 Stainless Steel
- 4.3.5 Sheet metal screws for fastening the metal weather proofing to steel supports shall be # 7 x 15 mm long style B, type 304 Stainless Steel hexagonal head, self-tapping and have a neoprene washer under the head.
- 4.3.6 Sheet metal screws for metal weatherproofing lap joints shall be # 7 x 10 mm long, style, type 304 Stainless Steel pan head self-tapping and have a neoprene washer under the head.
- 4.3.7 Mastic weather coat, emulsion type polymeric protective coating shall be breathing type fire resistive in the dried state. The applied total dry film thickness shall be nominal 1.5-2 mm for trowel application having a maximum surface temperature of 54°C. [Equivalent to foster seal-mastic 31-49, Aluminium grey, seal flash G-P-M mastic 35-01/45-01.].
- 4.3.8 Glass cloth (4 x 4 strand/CM open mesh) shall be used as reinforcing or bonding agent for coating and adhesives.
- 4.3.9 Expansion springs shall be type 304 stainless steel, 4" long.
- 4.3.10 Weld pins and speed washer shall be 2.5mm type 304 stainless steel. Self-locking washer may be 50mm round or square.
- 4.3.11 Floating rings, which are used for insulation support on vessel heads, shall be 6mm round stainless steel rod with butt-welded ends.
- 4.3.12 Difficult shapes and small bore piping (under 1") may be weatherproof with mastic, with the approval of purchaser.