

Engineering Standard

SAES-H-204

29 June 2005

General Specifications and Application
Procedures of Heat-Shrink Sleeves to Coated Pipe

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Saudi Aramco DeskTop Standards

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Revised paragraphs are indicated in the right margin

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1 Scope

This Standard gives the mandatory requirements governing the storage, handling and installation of heat-shrink sleeves (primarily those described in [SAES-H-002](#) for APCS-110, APCS-111 and APCS-112) which are used for coating the field girth weld area of externally coated pipe. The external pipe coating may be fusion-bonded epoxy (APCS-104), polyethylene (APCS-105), polypropylene (APCS-115), or Rayclad 120/B.

2 Conflicts and Deviations

- 2.1 Any conflicts between this standard and other applicable Saudi Aramco Engineering Standards (SAESs), Materials System Specifications (SAMSSs), Standard Drawings (SASDs), or industry standards, codes, and forms shall be resolved in writing by the Company or Buyer Representative through the Manager, Consulting Services Department of Saudi Aramco, Dhahran.
- 2.2 Direct all requests to deviate from this standard in writing to the Company or Buyer Representative, who shall follow internal company procedure [SAEP-302](#) and forward such requests to the Manager, Consulting Services Department of Saudi Aramco, Dhahran.

3 References

The selection of material and equipment, and the design, construction, maintenance, and repair of equipment and facilities covered by this standard shall comply with the latest edition of the references listed below, unless otherwise noted.

Saudi Aramco Engineering Procedures

SAEP-302	<i>Instructions for Obtaining a Waiver of Mandatory Saudi Aramco Engineering Requirements</i>
SAEP-316	<i>Performance Qualification of Coating Personnel</i>

Saudi Aramco Engineering Standards

SAES-H-002	<i>Internal and External Coatings for Steel Pipelines and Piping</i>
SAES-H-200	<i>Storage, Handling, and Installation of Externally Coated Pipe</i>
SAES-H-204V	<i>Approved Vendor Installation Procedures for Heat-Shrink Sleeves</i>

4 Material Storage and Handling

- 4.1 Materials shall be stored and handled in accordance with the Manufacturer's recommendations. As a minimum, materials shall be stored in a ventilated building or sun shelter.
- 4.2 The sleeves shall not be removed from their factory packaging or equivalent until they are ready for use in order to keep dirt and other contaminants off the sleeves. When the sleeve material is supplied in rolls and cut to size on-site, the rolls, and the sleeves cut from them, shall be stored and handled in a manner that prevents contamination.

5 Design

- 5.1 Heat-shrink sleeves shall not be used in contact with liquid hydrocarbons, including oil-contaminated ground water.
- 5.2 Selection requirements for heat-shrink sleeves for various combinations of service temperature and pipe coating material are given in [SAES-H-002](#).
- 5.3 Minimum acceptable width of the sleeves shall be as follows:
 - a) For use on pipe coated with FBE, polyethylene, or Rayclad 120/B: 280 mm
 - b) For use on pipe coated with polypropylene: Width depends on the type of cutback used. The sleeve width shall be sufficient to overlap the pipe coating on each edge by a minimum of 50 mm after application.

6 Installation

- 6.1 General
 - 6.1.1 This chapter gives the surface preparation and sleeve application requirements applicable to all heat-shrink sleeve applications. Additional installation requirements (if any) for the specific heat-shrink sleeve being installed shall be given in the appropriate Saudi Aramco Approved Vendor Installation Procedures in [SAES-H-204](#) (attachment).
 - 6.1.2 Personnel installing and inspecting heat shrink sleeves shall be qualified in accordance with [SAEP-316](#), Supplement 1.
 - 6.2 Surface Preparation
 - 6.2.1 Prior to blast cleaning, all hydrocarbon contaminants shall be removed by solvent cleaning from the area on the pipe to be covered by the shrink
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sleeve. Kerosene, diesel, and similar degreasers that leave an oily film shall not be used. Use Saudi Aramco approved solvents.

6.2.2 Minimum surface preparation requirements of the bare steel girth weld area immediately prior to sleeve application are given in the appropriate APCS in [SAES-H-002](#). For sleeves used in conjunction with Rayclad 120/B coatings, the surface cleanliness of the bare steel girth weld area shall be at least Sa 2-1/2. Sand is prohibited as blasting abrasive. Weld spatter, weld slag, sharp edges, burrs, knurls. Any other sharp surface discontinuities shall be removed by grinding (or equivalent) prior to coating.

6.2.3 The mill-applied pipe coating (adjacent to the bare steel girth weld area) that will be covered by the shrink sleeve shall be dry and free of deleterious contaminants immediately prior to sleeve application.

6.2.3.1 For polyethylene-coated pipe, the mill coating adjacent to the bare steel girth weld area shall be feathered (chamfered) around the circumference for at least 10 mm.

6.2.3.2 For FBE-coated pipe, the gloss shall be removed from the FBE coating where it will be covered by the shrink sleeve by brush blasting, sanding, or similar. Wire brushes shall not be used for this purpose.

6.2.3.3 For polypropylene-coated pipe, refer to the approved installation procedure(s) in [SAES-H-204](#) (Attachment) for the specific heat shrink sleeve(s) approved for use with polypropylene coatings. Consult the RSA if there are any questions.

6.3 Application Procedures

6.3.1 Preheating shall be by propane torches or induction heaters.

6.3.1.1 Propane torches shall not be used for preheating on pipes with nominal diameter larger than 30 inches when APCS-110 or APCS-111 high temperature sleeves of the heat-activated type are to be installed.

6.3.1.2 Wind guards shall be used in conjunction with propane torches whenever needed to maintain proper preheat levels. The guards shall extend out from the pipe for at least 1 m except where hindered by the ditch.

- 6.3.2 Contact pyrometers shall be used for all temperature measurements. Temperature crayons shall not be used.
- 6.3.3 For primer-activated sleeves, the primer shall be applied in accordance with the Saudi Aramco Approved Vendor Installation Procedure in [SAES-H-204](#) (Attachment).
- 6.3.4 Immediately after application, and while the adhesive is still fluid, the sleeve shall be rolled with a hard roller to remove entrapped air. The roller must be in good condition, turning freely on its shaft, so that the sleeves are not damaged by the roller dragging across the sleeve surface. Unless a different procedure is specified in the Saudi Aramco Approved Vendor Installation Procedure in [SAES-H-204](#) (Attachment) for the sleeve being applied, rolling shall be in the circumferential direction, starting at the 6 o'clock position and progressing towards the 12 o'clock position. The entrapped air collected at the 12 o'clock position shall be expelled by rolling in the axial direction.
- 6.3.5 Heat shrink sleeves shall not be applied during rains or sandstorms unless effective provision is made to keep the pipe surface and the sleeve clean and dry.

7 Inspection Methods and Acceptance Criteria

7.1 General

This chapter gives the inspection methods and acceptance criteria applicable to all heat-shrink sleeve applications. If any Additional inspection required for specific type of sleeves shall be given in the approved installation procedure in [SAES-H-204](#) (Attachment).

7.2 Nondestructive Inspection

The shrunk-on sleeves shall exhibit all the characteristics outlined in the following paragraphs. Shrunk-on sleeves failing to meet all these characteristics shall be removed and replaced.

- 7.2.1 Both ends of the sleeve are bonded around the entire circumference.
 - 7.2.2 The sleeve shall be smooth. There shall not be any dimples, bubbles, punctures, burn holes, or any other signs of holidays in the coating or of entrapment of foreign matter in the underlying adhesive.
 - 7.2.3 For wrap-around sleeves, the total slippage of the closure patch during application shall not exceed 13 mm.
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7.2.4 The sleeve shall overlap the adjacent mill coating by at least 50 mm on each side.

7.3 Destructive Inspection

7.3.1 Window testing shall be carried out on one sleeve of every fifty installed or twice per shift whichever is the greater.

7.3.1.1 On each sleeve tested, at least one window each shall be cut in the patch overlap area, across the field girth weld, and in the body of the sleeve. Each window shall expose at least 1875 mm² (3 in²) of adhesive.

7.3.1.2 The girth weld shall be completely covered by adhesive.

7.3.1.3 If any voids extending to bare metal (or mill coating) or areas of no adhesion are found, their extent shall be determined, if necessary by removing the entire backing. The sleeve installation shall be acceptable if both of the following requirements are met:

- a) The maximum dimension of any of these defects does not exceed 50 mm.
- b) At least 95% of the adhesive layer is free of voids and/or lack of adhesion.

7.3.1.4 If the sleeve does not meet the acceptance criteria in paragraphs 7.3.1.2 and 7.3.1.3, the adjacent sleeves shall be destructively tested until acceptable installations are found on both sides of the defective installation. All sleeves not meeting the acceptance criteria shall be removed and replaced. Each replacement sleeve shall be window tested to verify that the defect(s) have been eliminated. This process shall continue until all the sleeve installations are acceptable.

7.3.1.5 Window test areas shall be repaired in accordance with the Approved Vendor Installation Procedure in [SAES-H-204](#) (Attachment).

7.4 Holiday test shall be done at the voltage specified for the main pipeline coating (see [SAES-H-200](#)) unless specified otherwise in the Scope of Work or other applicable mandatory Saudi Aramco document.

7.5 The Contractor shall maintain a record of all sleeves failing to pass any of the requirements in paragraphs 7.2 – 7.4 above in a form suitable to the Saudi Aramco Inspector. As a minimum, the record shall include the date of

inspection, location of the sleeve (using kilometer marking or GPS coordinates), nature of the defect(s), and the remedial action taken.

Revision Summary

29 June 2005

Minor revision to combine [SAES-H-204V](#) as attachment.
Revised the "Next Planned Update."

Attachments: Approved Vendor Installation Procedure

I - Nitto Neo Cover 1150-Art Heat-Shrink Tubular Sleeve

APPROVED INSTALLATION PROCEDURE

1. Surface Preparation

The bare steel girth weld area and the adjacent pipe coating that will be covered by the heat shrink sleeve shall be prepared in accordance with the following Saudi Aramco standards:

[SAES-H-204](#)

Applying Heat-shrink Sleeves to Coated Pipe

[SAES-H-002](#), *APCS-110*

*High Temperature Heat-Shrink Sleeves
primarily for use on FBE-coated pipe*

2. Preheating Requirements

The area to be covered with the sleeve (the bare pipe surface and the adjacent pipe coating) shall be preheated to over 150°C by propane Torches.

3. Application Requirements

- a) Put sleeves on pipes before field girth welding. Make sure the sleeves are far enough away from the girth weld area so that they will not be damaged by welding, surface preparation, or preheating.
- b) Surface preparation (see above).
- c) Preheating (see above).
- d) Center the sleeves over the girth weld.
- e) Start shrinking from one end of the sleeve and progress toward the other end.

Move the flame up and down at the same spot, don't move it from side to side.

4. Removal of Entrapped Air

Roll to remove entrapped air in accordance with [SAES-H-204](#).

5. Inspection

- 5.1 Inspection shall be in accordance with [SAES-H-204](#).
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5.2 The following repair procedure shall be applied in case of defects:

A. For Window Test Area:

- 1) The backing material of window test areas shall be cut-off.
- 2) The edges of windows shall be trimmed so that no tears remain on the backing sheet.
- 3) Repairing patches shall be applied as follows:

i) Patch material:

Use Nitto No. 1200 ART the same material (Backing and adhesive) as Neo Cover 1150 ART (RW 1230 ART), but not thermo retroactive sheet.

Following sizes are available:

100 mm, 150 mm, 200 mm wide x 10 m long rolls

- ii) Cut the tape to the size covering the window test area giving min. 50 mm overlap on all sides.
- iii) Preheat the area where the patch is applied to over 130°C by Propane Torch. Measure the temperature with a contact pyrometer.
- iv) Heat the adhesive side of the patch to the extent that the Hot-Melt Adhesive starts to melt.
- v) Immediately apply the patch over the repair area by hand.
- vi) Heat over the patch.
- vii) Roll the patch thoroughly while the adhesive is still fluid to expel entrapped air.

B. Complete Removal of the Backing:

- 1) Burn the adhesive and remove all remaining adhesive by scraper.
- 2) Apply Wrap-Around Sleeve RW 1230 ART in accordance with the approved application procedure.

II - Nitto Neo Cover RW 1230-Art Heat-Shrink Wrap-Around Sleeve

APPROVED INSTALLATION PROCEDURE

1. Surface Preparation

The bare steel girth weld area and the adjacent pipe coating that will be covered by the heat shrink sleeve shall be prepared in accordance with the following Saudi Aramco standards:

[SAES-H-204](#)

Applying Heat-shrink Sleeves to Coated Pipe

[SAES-H-002](#)

High Temperature Heat-Shrink Sleeves

[APCS-110](#)

Primarily for Use on FBE-Coated Pipe

2. Preheating Requirements

The area to be covered with the sleeve (the bare pipe surface and the adjacent pipe coating) shall be preheated to over 150°C by Propane Torches.

3. Application Requirements

- a) Surface preparation (see above).
 - b) Wrap the sleeve loosely over the pipe near to the girth weld but outside the preheat area applying the "Zigzag-end" at the starting position.
Start wrapping at the 11 to 12 o'clock position. The free end of the overlap wrapping end will then be approximately at the 10 to 11 o'clock position.
 - c) Heat the adhesive of the closure patch by Propane Torch to the extent to start melting the Hot-Melt Adhesive.
 - d) Apply the closure patch to the overlapped end to form a tube. The closure patch should be centered over the end of the overlap.
 - e) Heat over the closure patch by Propane Torch to adhere it pushing out wrinkles and entrapped air with a gloved hand or a roller.
 - f) Preheat the area (girth weld) where the sleeve is to be applied to over 150°C by Propane Torch.
 - g) Move to position the sleeve over the pipe and center it over the girth weld.
 - h) Shrink the sleeve by heating, starting at one end of the sleeve and progressing toward the other end.
Move the flame up and down, don't move it from side to side.
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4. Removal of Entrapped Air

Roll work to remove entrapped air shall be done in accordance with [SAES-H-204](#).

5. Inspection

5.1 Inspection shall be in accordance with [SAES-H-204](#).

5.2 The following repair procedure shall be applied in case of finding defects:

A. For window test area:

- 1) The backing material of window test areas shall be cut-off.
- 2) The edges of windows shall be trimmed so that no tears remain on the backing sheet.
- 3) Repairing patches shall be applied as follows:

i) Patch material:

Nitto No. 1200 ART

Use the same material (Backing and adhesive) as Neo Cover 1150 ART (RW 1230 ART), but not thermo retroactive sheet.

Following sizes are available: 100 mm, 150 mm, 200 mm wide x 10M long rolls

- ii) Cut the tape to the size covering the window test area giving min. 50mm over-lap on all sides.
- iii) Preheat the area where the patch is applied to over 130°C by Propane Torch. Measure the temperature with a contact pyrometer.
- iv) Heat the adhesive side of the patch to the extent that the Hot-Melt Adhesive starts to melt.
- v) Immediately apply the patch over the repair area by hand.
- vi) Heat over the patch.
- vii) Roll the patch thoroughly while the adhesive is still fluid to expel entrapped air.

B. Complete Removal of the Backing:

- 1) Burn the adhesive and remove the remaining adhesive by scraper.
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- 2) Apply Wrap-Around Sleeve RW-1230 ART in accordance with the approved application procedure.

Approval Date: October 19, 1985
Replaces: Revised

III - Raychem WPC 120 Heat Shrink Sleeve

APPROVED INSTALLATION PROCEDURE

1. Surface Preparation

The bare steel girth weld area and the adjacent pipe coating that will be covered by the heat-shrink sleeve shall be abrasive blast cleaned to near white metal, Sa 2-1/2, and shall be prepared in accordance with the following Saudi Aramco standard:

[SAES-H-204](#)

Applying Heat-Shrink Sleeves to Coated Pipe

2. Gas Torch Preheat Method

Move 30 - 60 cm (12 - 24 in) away from weld bead. Wrap sleeve around pipe, overlapping by the width of the closure patch. Leave 25 - 50 mm (1 - 2 in) of slack. (Let sleeve sag at the bottom of pipe).

Remove brown strips from back of closure patch.

Place closure patch in central position over sleeve overlap seam.

Apply heat to closure patch until temperature indicating paint changes color. Do not overheat, as this can cause premature shrinkage of the sleeve. Pat down and smooth out closure patch with a gloved hand.

Preheat entire surface to be covered by the heat shrink sleeve to a temperature of 230 - 260°C (445 - 500°F). Verify temperature using contact pyrometers.

Position sleeve over girth weld to insure a minimum of 50 mm (2 in) overlap on adjacent coating.

Start heating one edge of sleeve and shrink down a circumferential band so that the sleeve forms a cone. Move progressively towards other end of sleeve shrinking circumferentially until sleeve is fully shrunk and adhesive flows from edges.

3. Induction Heater Post-Heating Method

Wrap sleeve around girth weld and install closure patch, followed by shrinking down sleeve tightly to pipe surface.

Place induction coils around pipe over the sleeve area and energize coils for correct amount of time to provide a steel surface temperature beneath the sleeve of 230-245°C (445-475°F), remove coils.

4. Removal of Entrapped Air

Immediately after complete installation of sleeve either by propane preheating or induction post heating, roll the entire sleeve working from bottom to top of pipe using straight rollers. Finally, roll out air on top of pipe to one edge of sleeve using a concave roller.

5. Inspection

5.1 Inspection shall be in accordance with [SAES-H-204](#).

5.2 The following repair procedure shall be applied in case of finding defects:

A. For window test area:

Use PERP 120 patch repair coating in accordance with approved application procedure.

B. Complete removal of the backing:

Old sleeve shall be fully removed by heating and scraping using a knife. Surface to be re-prepared as per Section 1 above.

TORCH TYPE:

Installation shall be in accordance with Section 2.0 above.

INDUCTION HEATER:

Installation shall be in accordance with Section 3 above.

HTLP:

Installation shall be in accordance with the approved Raychem procedure for HTLP heat-shrink sleeve with primer-activated adhesive.

IV - Rahchem HTLP Heat-Shrink Sleeve with Primer-Activated Adhesive

APPROVED INSTALLATION PROCEDURE

1. Surface Preparation

The bare steel girth weld area and the adjacent pipe coating that will be covered by the heat-shrink sleeve shall be prepared in accordance with the following Saudi Aramco standards:

[SAES-H-204](#)

Applying Heat-Shrink Sleeves to Coated Pipes

[SAES-H-002](#)

High Temperature Heat-Shrink Sleeves

APCS-III

Primarily for Use on Polyethylene Coated Pipe and FBE Coated Pipe up to 80°C

The adjacent pipe coating that will be covered by the heat-shrink sleeve shall be de-glossed (abraded) by brush blasting, sanding, or power wire brushing.

2. Heating Requirements

Just prior to installing heat-shrink sleeve/primer. Preheat the entire bare steel surface and adjacent coating to minimum 60°C (140 °F) maximum 90°C (195°F) using propane gas torches.

3. Application Requirements

The 2 component primer shall be thoroughly mixed and applied to the bare steel and adjacent abraded mill coating. If required, apply high temperature filler mastic (S1113) adjacent to the weld bead before applying primer.

Wrap sleeve centrally around the weld joint insuring that adjacent coating is overlapped by a minimum of at least 50 mm (2"). Sleeve overlap shall be not less than 6 inches.

Apply primer between overlapped layers before closing overlap.

Remove release paper from the pressure sensitive adhesive strips of the closure patch and press in position centering over the exposed sheet end.

Use a propane torch, type Raychem FH 2601 to heat the closure patch evenly until the temperature sensitive paint changes color. Do not overheat, as this can cause premature shrinkage of the sleeve.

With a gloved hand, smooth the closure patch to eliminate possible entrapped air and ensure good bonding.

To shrink the sleeve, use 2 Raychem FH 2601 torches for pipe diameters above 16 inches, continuously move the torch in a paint brush motion circumferentially at one end until a band is completely recovered.

Finish by shrinking circumferentially towards the other end.

4. Removal of Entrapped Air/Wrinkles

During and after shrinking the sleeve, any entrapped air/or wrinkles shall be removed using rollers or a gloved hand. Expel all air to the sides of the shrink sleeve/closure patch.

5. Inspection

5.1 Inspection shall be in accordance with [SAES-H-204](#).

5.2 The following repair procedure shall be applied in case of findings defects:

A. For window test area:

Use "PERP" repair patches installed in accordance with the Approved Installation Procedure for "PERP" heat shrink repair patches.

B. For complete removal of the backings:

Prepare surface again as per [SAES-H-204](#) and [SAES-H-002](#) and install a complete new sleeve.

Approval Date: July 4, 1993
Replaces: December 10, 1985

V - Raychem PERP 120 Heat-Shrink Repair Patches (For Temperatures Up To 120°C)

APPROVED INSTALLATION PROCEDURE

1. Surface Preparation

Cut out the damaged polyethylene coating or heat-shrink sleeve, leaving only well-adhered coating. Make sure all sharp edges, cuts, and tears are removed.

Feather (chamfer) the coating transitions at an angle of approximately 45 degrees to prevent air entrapment when applying the repair materials. Clean all bare steel in the damaged area to near white metal, Sa 2-1/2, using abrasive blasting or clean emery paper.

Exception:

If the damaged area has well bonded adhesive covering the steel surface, it is not necessary to remove it. It is only necessary to remove any foreign matter from the adhesive.

De-gloss adjacent sound coating that will be covered by the PERP 120 patch by brush blasting, sanding or power wire brushing.

2. Application Requirements

Prior to preheating, cut the PERP 120 patch so that it extends at least 50 mm beyond the damaged area in all directions. Round off all patch corners.

If adhesive filler is required, cut the PERP-FILLER so that it fits the area to be filled.

Preheat the exposed steel surface to a temperature in the range 210 - 230°C. Preheat the adjacent coating that will be covered by the PERP 120 patch to a temperature in the range of 140 - 160°C.

Commentary Note:

In repair areas where well-bonded adhesive still covers the pipe, preheat the area to be covered by the PERP 120 patch to a temperature in the range of 140 - 160°C.

Immediately after the area has been preheated to the required temperature, apply the PERP-FILLER. Flame brush the filler in order to soften in and then smooth it down with a hot paint scraper blade. Maintain the preheat temperature in the range 140 - 160°C.

Flame brush the adhesive on the PERP 120 patch until it appears "wet" and then place the patch over the preheated, damaged area so that it overlaps the sound coating by at least 50 mm in all directions.

Heat the PERP 120 patch with a propane gas torch using a strong flame. As the patch begins to soften and conform to the profile of the underlying pipe, alternate heating and rolling with a hand roller. Roll from the center of the patch out towards the edges in order to remove entrapped air and ensure good contact. Continue to alternate rolling and heating until a small bead of adhesive is clearly visible all around the edge of the patch.

3. Handling

Allow the repaired area to cool to at least 60°C before handling.

4. Inspection

Inspection shall be per the requirements in [SAES-H-204](#).

Approval Date: October 12, 1996
Replaces: N/A

VI - Raychem PERP 80 Heat-Shrink Repair Patches (For Temperatures Up to 80°C)

APPROVED INSTALLATION PROCEDURE

1. Surface Preparation

Cut out the damaged polyethylene coating or heat-shrink sleeve, leaving only well-adhered coating. Make sure all sharp edges, cuts, and tears are removed.

Feather (chamfer) the coating transition to an angle of approximately 45 degrees to prevent air entrapment during the application of the repair material. Clean all bare steel in the damaged area to near white metal, Sa 2-1/2, by abrasive blasting or with clean emery paper.

Exception:

If the damaged area has well bonded adhesive covering the steel surface, it is not necessary to remove it. It is only necessary to remove any foreign matter from the adhesive.

Remove the gloss of adjacent sound coating that shall be covered by the PERP 80 patch by brush blasting, sanding or power wire brushing.

2. Application Requirements

Prior to preheating, cut the PERP 80 patch so that it will extend at least 50 mm beyond the damaged area in all directions. Round off all patch corners.

If filler mastic is required, cut the PERP-FILLER so that it fits the damaged area.

Preheat the exposed steel surface and the adjacent coating to a temperature in the range of 60 - 80°C.

Immediately after the area has been preheated, apply the PERP-FILLER mastic to the damaged area. Lightly flame brush the mastic to soften it and then smooth it down with a hot paint scraper.

Check that the temperature of the area to be covered by the PERP 80 patch is still in the range of 60 - 80°C and reheat the area if necessary.

Flame brush the adhesive side of the PERP 80 patch with a propane torch until the adhesive appears slightly "wet" and then immediately place the patch over

the damaged area so that it overlaps the sound coating by at least 50 mm in all directions.

Heat the PERP 80 patch with a medium flame from a propane gas torch.

3. Removal of Entrapped Air

Any entrapped air shall be removed by using a hand roller. This should be done as the polyethylene backing begins to soften and conform to the profile of the pipe.

Be careful not to roll the repair area too heavily as this may push out some of the mastic from the area to be filled. Apply intermittent heating during rolling until a small bead of adhesive is clearly visible all around the edge of the patch.

3. Handling

Allow the repaired area to cool to at least 60°C prior to handling the pipe.

4. Inspection

Inspection shall be per the requirements in [SAES-H-204](#).

Approval Date: October 12, 1996
Replaces: N/A

VII - UBE Joint Cover Torch Type CM Heat-Shrink Sleeve Using the Induction Heater "Post-Heating" Method of Application

APPROVED INSTALLATION PROCEDURE

1. Surface Preparation

The bare steel girth weld area and the adjacent pipe coating that will be covered by the heat shrink sleeve shall be prepared in accordance with the following Saudi Aramco Standards.

[SAES-H-204](#)

General Specification for Applying Heat-Shrink Sleeves to Coated Pipe

[SAES-H-002](#)
APCS-110

*High Temperature Heat-Shrink Sleeves
Primarily for Use on FBE-Coated Pipe*

[SAES-H-002](#)
APCS-111

*High temperature Heat-Shrink Sleeves
Primarily for Use on Polyethylene-Coated Pipe*

2. Drying

Warm the pipe surface to 50°C by propane torch or equivalent removing all traces of moisture from the surface.

Note: Warming is not required of the pipe surface if temperature is greater than 50°C.

3. Joint Cover Application

After removing the protective cover place one end of the Joint Cover against the pipe and tack it in position by heating with a propane torch or equivalent and pressing the heated part with gloved hand in order to make it contact the pipe surface evenly.

3.1 Specially, press that part of Joint Cover onto the weld bead and on the gaps between the weld and pipe mill coating carefully.

3.2 Wrap Joint Cover tightly around the pipe.

3.3 Heat the overlapped area of the Joint Cover and press firmly with gloved hand in order to achieve uniform contact with the other end of the Joint Cover.

4. Application of Closure Patch

4.1 Apply a closure patch centered over the outer end of the Joint Cover overlap.

4.2 Heat the closure with a propane torch or equivalent, until the thermo-chromic paint changes color.

Pat the closure patch with a gloved hand so that uniform sealing is achieved. Avoid overheating, as it may cause the sleeve to become loose.

5. Shrinking Process

5.1 Heat and shrink the Joint Cover along the weld bead by moving a propane torch up and down between the top and the bottom of the pipe.

Rub gently the shrunk part with a gloved hand to ensure complete contract, with no air voids.

5.2 Shrink one of the half sections found in step 5.1 by moving a propane torch up and down and progressing from the weld area towards the outer edge of the sleeve.

5.3 Repeat step 5.2 for the other half of the sleeve.

6. Induction Heating

6.1 Place a split type induction coil centrally over the Joint Cover and lock in position.

6.2 Heat the joint to give a steel temperature of at least 160°C (The corresponding temperature on the outside of the sleeve will normally be about 120°C but can vary depending on ambient conditions).

For polyethylene coated pipe per [SAES-H-002](#), APCS-105, bare steel temperature shall not exceed 175°C.

For fusion bonded epoxy coated pipe per [SAES-H-002](#), APCS-104, bare steel temperature shall not exceed 200°C.

6.3 Temperatures shall be checked using contact pyrometers.

Temperature melt crayons shall not be used.

6.4 Open the induction coil and remove from the pipe.

7. Entrapped Air Removal

7.1 The need for rolling to eliminate entrapped air shall be determined during the start-up phase of the job and by routine inspection per [SAES-H-204](#) during production.

The closure patch area, at least, usually requires some rolling.

7.2 When rolling is required to meet the acceptance criteria in [SAES-H-204](#), it shall be done immediately after shrinking is completed and while the adhesive is still fluid.

First, use the UBE weld profile roller (or equivalent) circumferentially around the weld bead. Then roll longitudinally starting next to the weld bead and moving towards the edge of the sleeve using contoured rollers. Do not roll directly on top of the weld bead.

7.3 Three kinds of rollers are available from UBE.

- 1) for pipe in 10 inch diameter or under
- 2) for pipe in 11 inch to 30 inch diameter
- 3) for pipe in 31 inch to 60 inch diameter

7.4 After finishing the application of roller pressure, apply once again a roller pressure starting from the point 2 inch from the weld bead on both sides so as to slide the adhesive to the direction of weld bead.

8. Inspection

8.1 Inspection shall be accordance with [SAES-H-204](#).

8.2 If rejectable defects are found the repair procedure shall be as follows:

- a) Window test areas
UBE Technical Report No. 0970-5891
"Approved Patch Repair Procedure for Use with UBE Joint Cover"
- b) Complete backing removal
 - i) Repair voids in the adhesive that remains on the pipe by a scraper heated with gentle flame of propane torch.
 - ii) Apply a new UBE Joint Cover sleeve in accordance with this procedure.

VIII - UBE Joint Cover Torch Type CM Heat-Shrink Sleeve Using the Propane Torch "Pre-Heating" Method of Application to FBE-Coated Pipe

APPROVED INSTALLATION PROCEDURE

1. Preparation

The bare steel girth weld area and adjacent pipe coating that will be covered by the heat shrink sleeve shall be prepared in accordance with the following Saudi Aramco Standards.

[SAES-H-204](#)

General Specification for Applying Heat-Shrink Sleeves to Coated Pipe

[SAES-H-002](#)
[APCS-110](#)

*High Temperature Heat-Shrink Sleeves
Primarily for Use on FBE-Coated Pipe*

2. Pre-Setting the Sleeve on Coated Portion

2.1 Wrap a sleeve around the pipe.

2.2 The adhesive layer of the sleeve edge at the overlap is heated with gentle flame of propane torch and this part of the sleeve is pressed down against the underlying sleeve.

2.3 Make sure the gap between the bottom of the sleeve and pipe bottom is 1 - 2 inches.

3. Setting Closure Patch

3.1 Apply the closure patch centered over the outer end of the Joint Cover overlap.

3.2 Heat the closure patch uniformly all over until the color of thermo-chromic paint changes. Be careful so that the flame of torch is kept away from pipe coating.

3.3 Pat the closure patch with gloved hand firstly on center, then towards both ends so that adhesion would become strong enough.

4. Pre-Heating

4.1 Heat the girth weld area to 160°C minimum, 200°C maximum.

4.2 Temperature shall be checked using contact pyrometers. Temperature melt crayons shall not be used.

5. Positioning the Sleeve

Slide the sleeve so that the center of the sleeve is set on the weld bead.

6. Shrinking

6.1 Heat and shrink the Joint Cover along the weld bead by moving a propane torch up and down between the top and the bottom of the pipe. Avoid excess heating on closure patch. If closure patch slides, it indicates over-heating, in case closure patch is excessively heated, re-apply new sleeve in accordance with step 8.

6.2 After shrinking on the weld bead portion, massage the shrunk part with a gloved hand to ensure complete contact, with no air voids.

6.3 Heat and shrink one half of the sleeve from the center toward one edge by moving the torch up and down along the circumferential direction, holding the flame perpendicular to the pipe surface. Maintain a "cone" shape as the sleeve is progressively shrunk on, in order to minimize entrapped air.

Avoid excess heating of closure patch. If closure patch slides, it indicates over-heating. In case closure patch is excessively heated, re-apply new sleeve in accordance with step 8.

6.4 Do the same thing for the other half of the sleeve.

6.5 Heat shrinking is completed when the last part of the end is shrunk and fits tightly to the coating surface.

7. Entrapped Air Removal

7.1 The need for rolling to eliminate entrapped air shall be determined during the start-up phase of the job and by routine inspection per [SAES-H-204](#) during production.

When rolling is required to meet the acceptance criteria in [SAES-H-204](#), it shall be done immediately after shrinking of the sleeve while adhesives are still fluid.

Re-heat the sleeve, if necessary, in case adhesive becomes hard and elimination of entrapped air becomes difficult.

Rolling is done longitudinally starting from the bead toward the sleeve edges.

Avoid excess rolling on weld bead.

7.2 Do the same on closure patch.

Two kinds of rollers are available.

- 1) for pipe in 10 inch diameter or under
- 2) for pipe in 11 inch to 30 inch diameter

8. Inspection

8.1 Inspection shall be in accordance with [SAES-H-204](#).

8.2 The following repair procedure shall be applied in case of finding defects:

After heating up of sleeve surface by propane torch and adhesive becomes soft, cut sleeve horizontally and remove sleeve circumferentially. When sleeve is cut, pre-caution is required not to damage the coating surface.

Heat the remaining adhesive and remove the bulk of the adhesive with scraper.

Clean the pipe surface with wire brush and then abrade with 80 grit emery paper.

Avoid excess abrasion on the coating surface.

No need to use solvent as adhesive can be easily removed by above cleaning.

However in case oil and/or grease are sticking on the surface, use non-oil based solvent for removing them.

Apply new sleeve as normal procedure.

8.3 Window test areas shall be repaired as follows:

UBE technical report No. 0970-5891.

Approved Patch Repair Procedure For Use With UBE Joint Cover.

IX - UBE Technical Report No. 0970-5891 Approved Patch Repair Procedure for Use with UBE Joint Cover

The following procedure shall be used when making patch repairs to window test areas and similar small defects in UBE Joint Cover heat-shrink sleeves used on Saudi Aramco jobs.

1. Sealant and patch sheet for small damage
 - 1.1 The sealant shall be UBE RMS 2100.
 - 1.2 The patch sheet material shall be UBE RMH 1400.
 2. Tools for repairing by patch method
 - Propane Torch
 - Tapping Tool
 - Scissors
 - Knife
 - Thermometer
 3. After taking off the test coupon, apply a piece of sealant (RMS) smaller than the size of window test area.
 4. Heat the sealant.
 5. Extend the hot sealant with a scraper.
 6. Apply a piece of sealant.
 7. Heat the sealant.
 8. The window test area shall be molded with a sealant more or less thicker than the JOINT COVER surface.
 9. Cut a piece of the patch sheet (RMH) larger by 5 to 10 cm than the window test area.
 10. Cut the corner of the patch sheet.
 11. Apply a patch sheet centering in the window test area.
 12. Heat from the center to each edge.
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13. Tapping from the center to the edge to drive away the entrapped air.

14. Heat again

Commentary Note:

The lower part of the patch sheet shall be heated more than the upper part because the torch flame is apt to go upward.

15. Tapping again

Commentary Note:

The cycle of heating and tapping shall be done at least five times even in a hot season to get an adequate adhesive strength.

16. The final point of heating can be confirmed by a slight hollow which is produced when the four corners are pressed by finger.

17. Immediately after heating the patch sheet, press all the edges by finger to get an adequate adhesive strength.

Approval Date: March 24, 1986
Replaces N/A

X - Canusa GTS-HT Heat-Shrink Wrap-Around Sleeve

APPROVED INSTALLATION PROCEDURE

1. Surface Preparation

The bare steel girth weld area and the adjacent pipe coating that will be covered by the heat shrink sleeve shall be prepared in accordance with the following Saudi Aramco standards:

[SAES-H-204](#)

Applying Heat-Shrink Sleeves to Coated Pipe

[SAES-H-002](#)

High Temperature Heat-Shrink Sleeves

APCS-110

Primarily for Use on FBE-coated Pipe

2. Sleeve preparation

Wrap the sleeve loosely around the pipe near (but not over) the area to be preheated. Ensure that the overlap covers the corner cuts on the sleeve. Allow approximately 25 mm of sag in the sleeve below the pipe.

Gently heat the adhesive side of the overlap and press the overlap into place.

Remove any release liners from the Type CLH closure seal and pre-heat the adhesive side of the entire closure seal evenly, using a low flame, until a shiny finish develops on the adhesive. Slightly heat the overlap area of the sleeve, moving the flame from side to side. Center the closure seal on the overlap area and, using a gloved hand, press the closure seal firmly down onto the sleeve.

Gently heat the closure with a medium flame. Using a gloved hand, ensure the closure seal is evenly in contact with the sleeve. Smooth out any wrinkles or entrapped air by working them outward from the center of the closure seal with a roller or a gloved hand.

- 1) Preheating Requirements (for pipe diameters up through 30 inches)
- 2) Preheat the area to be covered by the sleeve to a minimum temperature of 190°C (375°F) using a propane torch.

Commentary Note:

For pipe diameters larger than 30 inches, an induction heater must be used.

- 3) Use a contact pyrometer to verify the correct temperature has been reached over the entire area to be covered by the sleeve as well as at least 50 mm on either side of the sleeve.
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3. Sleeve Application

- a) Slide the sleeve over the area to be covered, centered on the girth weld. Using a low flame, begin at the center of the sleeve and heat circumferentially around the pipe. Use broad strokes. If utilizing two torches, the operators should work on opposite sides of the pipe.
- b) Continue heating from the center toward one end of the sleeve until the sleeve is snug (indicating that recovery is complete) and adhesive oozes out at the sleeve edges all around the circumference. In a similar manner, heat and shrink the other side of the sleeve.
- c) Finish heating the sleeve using long, horizontal strokes over the entire surface, including the closure, to achieve a uniform bond.
- d) While the sleeve is still hot and soft, use a hand roller to remove entrapped air. Roll from the bottom of the sleeve towards the top to collect the entrapped air. Then roll longitudinally to remove the air.

4. Inspection

Inspection shall be in accordance with [SAES-H-204](#). Window test areas shall be repaired using Canusa CRP-HT repair patch.

Approval Date: February 12, 2000
Replaces: N/A

XI - Canusa GTS - PP Heat-Shrink, Wrap-Around Sleeve for Polypropylene and High Temperature FBE Coated Pipe

APPROVED INSTALLATION PROCEDURE

1. Surface Preparation
 - a) Abrade the bare steel portion of the girth weld area to near white metal (Sa 2-1/2, SSPC SP10).
 - b) Lightly abrade the adjacent exposed FBE coating (to remove the gloss) and the mainline polypropylene coating to a distance approximately 100 mm beyond where the sleeve will be, using brush blasting, sanding, or similar.
 - c) If the FBE coating has visible holidays after abrasion, repair them using Canusa 2-part epoxy. Mix the Canusa primer curing agent with the base in the ratio of 4 parts by volume base to one part by volume curing agent. Stir for at least 30 seconds to assure uniform mixing. Apply the mixed epoxy uniformly over the surface to be repaired. After the repair epoxy has been applied, the minimum dry film thickness in the repaired area (epoxy plus FBE) shall be 14 mils (350 micrometers).

 2. Sleeve preparation
 - a) Trim a piece, approximately 40 mm long and 20 mm wide, off each of the corners of the under-lap end of the sleeve. Wrap the sleeve loosely around the pipe near (but not over) the area to be preheated. Ensure that the overlap covers the corner cuts on the sleeve. Allow approximately 50 mm of sag in the sleeve below the pipe.
 - b) Gently heat the adhesive side of the overlap and press the overlap into place.
 - c) Trim the corners off the Type CLH closure seal. Remove any release liners from the Type CLH closure seal and pre-heat the adhesive side of the entire closure seal evenly, using a low flame, until a shiny finish develops on the adhesive (7 - 10 seconds).
 - d) Slightly heat the overlap area of the sleeve where the closure seal will be placed, moving the flame from side to side. Center the closure seal on the overlap area and, using a gloved hand, press the closure seal firmly down onto the sleeve. Press from the center to the ends to ensure good contact is made between the entire closure seal and sleeve.
 - e) Gently heat the closure with a medium flame. Using a gloved hand, ensure the closure seal is evenly in contact with the sleeve. Smooth out any
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wrinkles or entrapped air by working them outward from the center of the closure seal with a roller or a gloved hand.

3. Preheating Requirements (for pipe diameters up through 30 inches)

- a) Use heat shields to protect the mainline polypropylene coating from the propane torch. Preheat the area to be covered by the sleeve to a minimum temperature of 195°C (383°F) using a propane torch.

Commentary Note:

For pipe diameters larger than 30 inches, an induction heater must be used.

- b) Use a contact pyrometer to verify the correct temperature has been reached. (The use of temperature-indicating crayons is not allowed.)

4. Sleeve Application

- a) Remove the heat shields.
 - b) Remove the release liner from the Canusa N-adhesive and apply the N-adhesive strips over the polypropylene coating that will be covered by the heat shrink sleeve. Overlap the ends of the adhesive strips by approximately 25 mm.
 - c) Carefully slide the sleeve over the N-adhesive strips and onto the area to be covered, centering the sleeve on the girth weld. Ensure that the N-adhesive strips have not been moved.
 - d) Using a low flame, begin at the center of the sleeve and heat circumferentially around the pipe. Use broad strokes. If utilizing two torches, the operators should work on opposite sides of the pipe.
 - e) Continue heating from the center toward one end of the sleeve until the sleeve is snug (indicating that recovery is complete) and adhesive oozes out at the sleeve edges all around the circumference. In a similar manner, heat and shrink the other side of the sleeve.
 - f) Finish heating the sleeve using long, horizontal strokes over the entire surface, including the closure, to achieve a uniform bond.
 - g) While the sleeve is still hot and soft, use a hand roller to remove entrapped air. Roll from the bottom of the sleeve towards the top to collect the entrapped air. Then roll longitudinally to remove the air.
 - h) Allow the sleeve system to cool to at least 45°C (113°F) before continuing. Using a blue oxidizing flame from the propane torch, quickly pass the flame tip across the mainline coating and each edge of the shrunken sleeve in the location where the Canusa 2-part epoxy will be applied. (Essentially, a circumferential band about 75 mm wide, centered on the
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edge of the sleeve.) Mix the Canusa primer curing agent with the base in the ratio of 4 parts by volume base to one part by volume curing agent. Stir for at least 30 seconds to assure uniform mixing. Apply the 2-part epoxy in a band approximately 50 mm wide (centered on the edge of the sleeve) around the entire circumference of the pipe at both ends of the sleeve. Ensure there is a smooth transition between the sleeve and the polypropylene coating.

5. Inspection

- a) Inspection of the installed sleeve over the bare steel and FBE cutback areas shall be in accordance with [SAES-H-204](#). Window test areas shall be repaired using Canusa CRP-HT repair patch.
- b) Where the sleeve overlaps the polypropylene coating, the only inspection required is that the sleeve is snug and smooth and that the epoxy seal is (1) visually continuous and (2) bonded to both the polypropylene and the sleeve. (The epoxy seal should resist moderate pressure from a knife blade inserted into the epoxy / substrate interface. Upward pressure should result in small pieces of epoxy breaking off but no large flakes.)

Approval Date: February 20, 2004
Replaces: Canusa GTS-PP replaces Canusa GTS-HT-PP