Raychem

STS Skin-Effect Trace-Heating Systems

STS-HV Installation and Construction Manual

chemelex

Throughout the guide the following symbol: ⚠ **Warning:** identifies particularly important safety warnings that must be followed.

⚠ **Warning:** Shock Hazard
Electrical testing of the STS system can create a risk of shock due to the high voltages being used. Be sure to observe all local safety precautions and the recommendations of the test equipment manufacturer. In addition, follow all the instructions and warnings contained in this manual.
Take appropriate measures to ensure that no personnel can contact the STS wire while it is under test. Be sure to discharge the test equipment or leave it connected and off until the residual charge has dissipated and the voltage has returned to zero.

⚠ **Important:**
Ensure that the carrier pipe is in good condition prior to welding the heat tube. Always verify that existing pipes are empty and purged prior to welding the heat tube and always obtain any necessary permits from plant operations.

⚠ **Important:**
When welding, be careful not to undercut, pit or burn through either the heat tube or the carrier pipe. Undercutting, pitting and burn through are not allowed and can result in pipeline leakage or STS system failure.

⚠ **Important:**
Once the wire is installed, no further welding may be performed on the carrier pipe or heat tube, as damage to the wire will result. Ensure that all pipeline and heat tube inspection and testing has been completed and accepted prior to wire installation.

⚠ **Important:**
Be careful to obey any maximum exposure temperature limits that apply to the system. Steam cleaning, or any other high temperature pre-commissioning operations that may be required and would potentially exceed the exposure temperature limits, should be performed prior to installing the STS wire.

⚠ **Warning:** Shock Hazard
Very high test voltages (up to 24 kV) are used. Take appropriate measures to assure that no personnel can come into contact with the STS wire while it is under test!

⚠ **Warning:** Shock Hazard
The STS wire and heat tube act like a large capacitor and will hold the test voltage for a considerable length of time after turning the test equipment off. Be sure to leave the test equipment connected and off until the residual charge has dissipated and the voltage has returned completely to ZERO.

TABLE OF CONTENTS

1. GENERAL INFORMATION

1.1 Use of the manual

This manual covers Chemelex Industrial Heat Tracing Solutions STS Skin-effect Tracing Systems for long pipelines installed above ground or underground in ordinary or hazardous locations.

Follow the installation instructions included with the project specific engineering documents and drawings. For the Chemelex warranty and agency approvals to apply, you must follow the instructions in this manual, and all project-specific engineering drawings and documents. In the event that there is a conflict between details and procedures shown on the project-specific engineering drawings and documents and the details and procedures shown in this document, contact Chemelex for clarification.

1.2 Electrical codes and standards

Applicable sections of Articles 426 and 427 of the US National Electrical Code (NEC), clauses of the Canadian Electrical Code and standards IEEE Std 844.1-17/CSA C22.2 No. 293.1-17, apply in particular to skin-effect systems. Other international or local codes may apply to the STS system installation. Be sure to follow all applicable codes and standards. If there is any question regarding the applicability of certain codes or standards, please contact Chemelex.

1.3 Safety guidelines

The safety and reliability of any heat-tracing system depends on both the quality of the products selected and the manner in which they are designed, installed and maintained. Incorrect handling, installation, or maintenance of any of the system components can cause insufficient heating, overheating of the pipe, or damage to the heat tracing system, which may result in system failure, electric shock, or fire. The information, warnings, and instructions contained in this guide are important. Read and follow them carefully to minimize these risks and to ensure that the system performs reliably.

Throughout the guide the following symbol: ⚠ **Warning**: identifies particularly important safety warnings that must be followed.

1.4 Approvals and codes

Conditions for Safe Use: Refer to Hazardous Area certification. Certificate No. and Marking

PTB 21 ATEX 1005 X	IECEx PTB 21.0011X
Ⓔx II 2 G Ex eb 60079-30-1 IIB T6...T3 Gb	Ex eb sb IIB T6...T3 Gb
Ⓔx II 2 D Ex tb IIIB T80°C...T200°C Db	Ex tb sb IIIB T80°C...T200°C Db

All heat-tracing-systems must be installed in compliance with all national or local electrical regulations and codes of practice.

1.5 STS-HV wire, splice & termination specifications

Rated STS voltage	10000 Vac
STS-HV Wire Minimum Installation Temperature	–55°C
STS-HV Splice & Power Termination Minimum Installation Temperature	0°C
Maximum Service Temperature	150°C

1.6 Fiber optic temperature monitoring

If fiber optic temperature monitoring is used with the skin-effect system, refer to the Installation, Testing, and Operational Instruction Manual and the data sheets and drawings issued as project specific documents.

1.7 Custom STS heating applications

If subsea, structural, or custom modifications are required with the skin-effect system, refer to the Installation, Testing, and Operational Instruction Manual and the data sheets and drawings issued as project specific documents.

1.8 Document retention

Retain this manual for the life of the system.

1.9 Data retention

Retain data for the life of the system.

2. MATERIAL STORAGE AND HANDLING

Store the heat tube off the ground in a location that will not be subject to flooding or physical damage. Keep the heat tube dry and free from dirt and debris. Ensure that the heat tube ends are capped at all times to prevent any debris from entering the tube, as it is much easier and less costly to keep the tube clean than to have to clean out mud, stones or other debris after installing it on the pipe.

STS tracing wire should be handled with care. DO NOT lift reels using a fork lift between the flanges of the reel as this will damage the tracing wire. The two options are to either secure the reel to a pallet and to lift the pallet, or to secure a reel arbor to the reel and to lift the arbor.

STS transformers and control systems must likewise be handled with care, as dropping or rough handling will cause damage to the equipment.

Store the STS electrical materials in a secure, dry storage facility. Protect the equipment from physical damage caused by traffic through the storage area, flooding, or other causes.

STS electrical equipment such as switchgear and control panels, transformers, and load balancing units shall be stored as directed by the equipment supplier or in Chemelex' project specific Operation and Maintenance Manual.

3. INSTALLATION AND QUALITY CONTROL SEQUENCE

Installation of an STS system must proceed in a sequence, in order to ensure that the installation work of one component does not result in damage of another (previously installed) component. Shown below is a progression of how the installation should proceed.

3.1 Mechanical and pipeline electrical work

- Installation and inspection of the heat tube, couplings, and pullboxes
- Testing the heat tube
- Installation and inspection of the power connection, jumper, and end boxes
- Installation of the STS wire, wire splices and terminations
- Testing of the STS wire

3.2 Electrical equipment work

- Installation of the control/switchgear panel, transformer, and load balancer
- Installation of the RTD
- Installation of the interconnection wiring

3.3 Completion and commissioning

- Pre-commissioning inspections
- Commissioning

Note: Depending on the project, the mechanical and electrical work can proceed in parallel; however it is critical to ensure that wire installation does not begin until the applicable sections of the pipeline and heat tube have been installed, inspected, tested, and signed-off.

4. INSTALLATION OF HEAT TUBE

The heat tube installation method required for each system will be shown on the system specific drawings supplied by Chemelex. Depending on the design requirements, the heat tube may be strapped or welded to the carrier pipe. The spacing between the straps or weldments is shown on the Heat Tube Installation Details sheet of the engineering drawings.

4.1 Carrier pipe preparation for existing pipelines

⚠ **Important:**
Ensure that the carrier pipe is in good condition prior to welding the heat tube. Always verify that existing pipes are empty and purged prior to welding the heat tube and always obtain any necessary permits from plant operations.

4.2 Heat tube preparation

The heat tube must be checked and prepared prior to installation on the carrier pipe. Failure to do so may result in complications during the installation of the STS tracing wire, and may cause damage to the tracing wire.

Check each piece of heat tube to be certain that it is the proper size as per the specification in the design sheet. It is important to ensure that each tube is clean and dry on the inside. If any water or debris is found in the heat tube, clean it out while the tube is still on the ground and easily accessible.

The inside edges of both ends of the heat tube must be de-burred using a reamer. This must be done at all ends of all tube pieces, just prior to installation on the pipe.

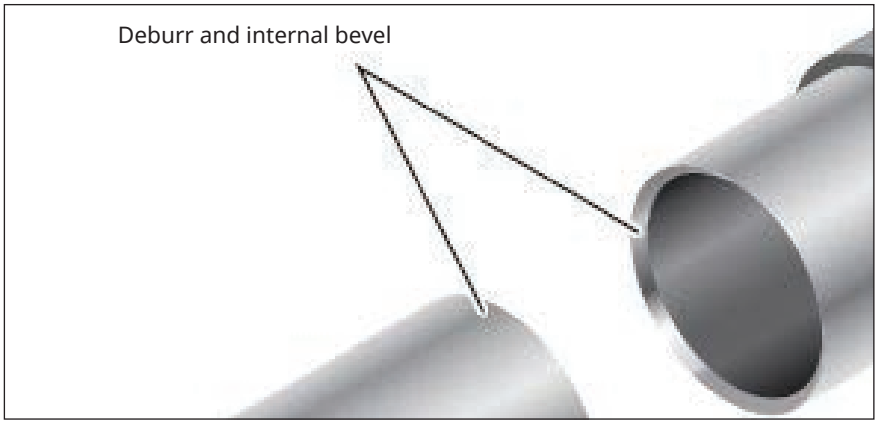

Figure 1: Cutaway view of heat tube end preparation

4.3 Heat tube joints (couplings)

The heat tube joints are joined by welding the heat tube to specially made socket weld sleeves (couplings). The coupling welds must be air tight, in order to ensure adequate electrical conductivity and protection from water ingress.

There are two types of heat tube joints. For a typical field installation, or when installing two short lengths of tube on a longer length of pipe (as in shop pre-fabrication), only a coupling is necessary to join tube sections, see Figure 2. In cases where the heat tubes are already fixed to the pipeline prior to tube joining (as when making field joints of pre-fabricated pipe sections), an additional part called a Heat Tube Guide is required, see Figure 3.

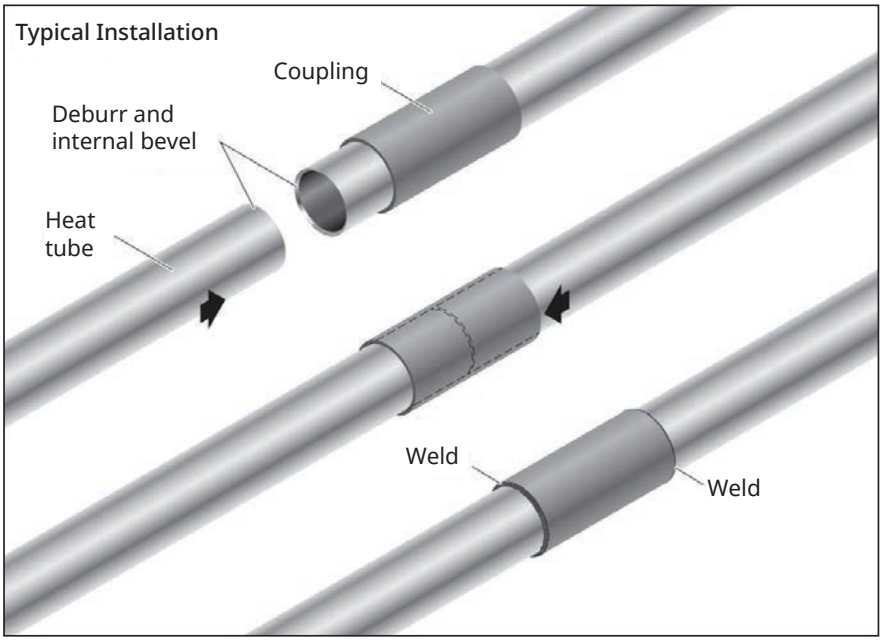

Figure 2: Cutaway view of heat tube coupling (no guide used)

Note: Orbital welding can be used to make heat tube joints if approved by Chemelex and the customer.

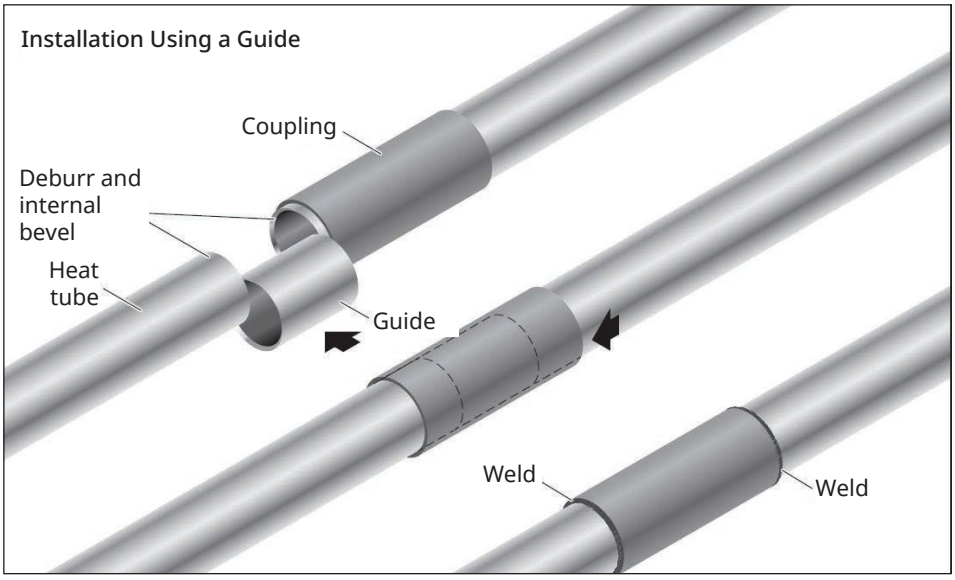

Figure 3: Cutaway view of heat tube coupling with guide

4.4 Heat tube attachment

Welded Attachment

A 3 mm (⅛") fillet weld is used to attach the heat tube to the carrier pipe. DO NOT weld directly over the carrier pipe butt welds or ERW seam welds. In all cases where welding of the heat tube to the carrier pipe is required, the weld length and skip length dimensions and specific weld details will be specified on the Chemelex project drawings.

Note: Figures 4 and 5 display the proper heat tube attachment welds.

⚠ **Important:**
When welding, be careful not to undercut, pit or burn through either the heat tube or the carrier pipe. Undercutting, pitting and burn through are not allowed, and can result in pipeline leakage or STS system failure.

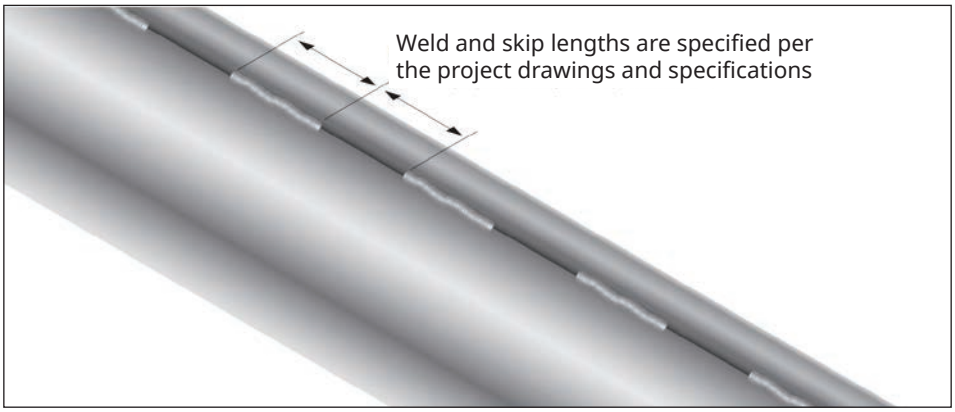

Figure 4: Heat tube attachment with skip weld

Figure 5: Heat tube attachment with continuous weld

The procedure for a welded heat tube attachment is:

1. Position the heat tube in the correct orientation on the pipeline. Be sure to check the end offset (or cut back) dimensions when shop fabricating pipe spool pieces.
   End offset dimensions will be given on the Chemelex project drawings.
2. Temporarily fix the heat tube to the pipeline using straps or clamps, or apply a tack weld every 3 meters (10') between the heat tube and pipeline along the opposite side from the main welding.
3. Weld couplings in place (not required for shop pre-fabrication, unless short lengths of tube need to be joined on a single pipe spool).
4. Weld the heat tube in accordance with the dimensions shown on the Chemelex project drawings.

Strap-On Attachment

When the Chemelex Project drawings call for strapping on the heat tube (instead of welding), use the following procedure. Be sure to use the proper strapping material and spacing as specified on the Chemelex project drawings.

1. Position the heat tube in the correct orientation on the pipeline. Be sure to check the end offset (or cut back) dimensions when shop fabricating pipe spool pieces. End offset dimensions will be given on the Chemelex project drawings.
2. Temporarily fix the heat tube to the pipeline using straps or clamps.
3. Weld couplings in place (not required for shop pre-fabrication, unless short lengths of tube need to be joined on a single pipe spool).
4. Tightly apply permanent strapping, observing the spacing requirements shown on the Chemelex project drawings. Heat tube must be pulled tight against the pipeline at each strap.

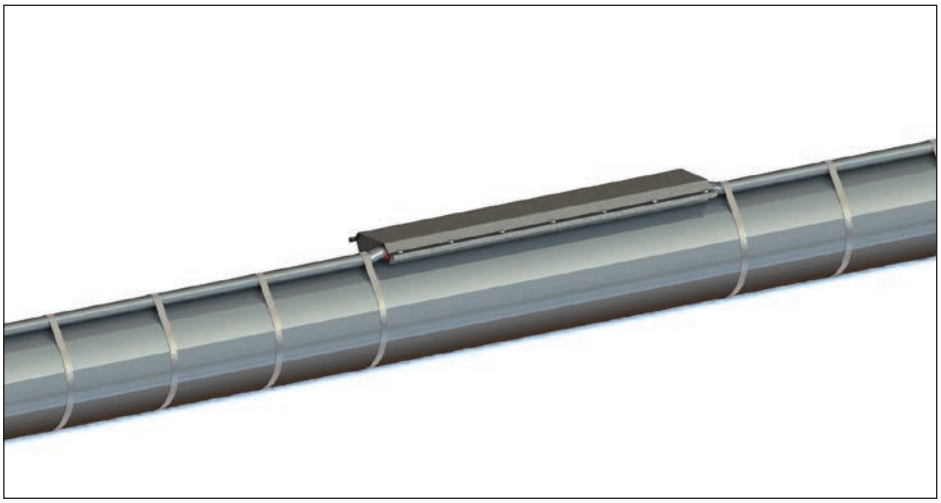

Figure 6: Heat tube strap-on attachment

4.5 Heat tube installation on elbows

One of the more difficult areas of heat tube installation involves pipe fittings (most commonly elbows). It is important that the tube be kept in contact, or very nearly in contact, with the carrier pipe at all times. Accomplishing this on elbows, tees or other fittings requires planning and care. Failure to maintain contact will result in insufficient heat transfer from the heat tube to the pipe, resulting in cold spots on the carrier pipe and potential failure of the heat tracing system.

Note: The heat tube must be tight against the pipeline at all points. Gaps of more than 10 mm (½") between the heat tube and the pipeline are not allowed unless explicitly shown on the Chemelex project drawings for the system. Gaps between the heat tube and the carrier pipe that are less than 10 mm (½") shall be corrected as follows:

1. For systems with the heat tube welded to the pipeline:
    a. Where the gap between the heat tube and the carrier pipe is less than 3 mm (⅛"), fill the gap by welding so that the welded and un-welded lengths are within those specified for the system.
    b. Where the gap between the heat tube and the carrier pipe is greater than 3 mm (⅛"), insert a mild steel filler material (such as steel rod or plate) and weld in place to both the carrier pipe and the heat tube.
2. For systems with the heat tube strapped to the pipeline:
    a. Where the gap between the heat tube and the carrier pipe is less than 3 mm (⅛"), use a ratchet strap to pull the heat tube down and add additional banding to eliminate the gap.
    b. Where the gap between the heat tube and the carrier pipe is greater than 3 mm (⅛"), use a ratchet strap to pull the heat tube down and add additional banding to eliminate the gap, or insert a mild steel filler material (such as a steel rod or plate) and weld in place to the heat tube only.

If welding is used to fill any gap and corrosion resistant paint or coating is used on either the carrier pipe or tube, be sure to apply touch up coating as required after welding.

Depending on the orientation of the heat tube, it may be necessary to sweep the tube to a different orientation on an elbow. Generally speaking, the tube should run along the side or back of an elbow. DO NOT run the tube through the throat of the elbow if the bend radius of the tube will be less than the minimum value listed in Table 1, since it will be virtually impossible to maintain contact between the tube and the carrier pipe elbow.

When approaching an elbow where the tube's orientation will run it into the throat of the fitting, begin sweeping the tube to the side a few feet ahead of the elbow.

4.6 Heat tube bending

Always maintain a bend radius of at least a 5 times the nominal heat tube diameter and take care not to deform the tube when bending. The ID of the heat tube must not become restricted or the STS tracing wire may not be able to be pulled in. Table 1 lists the minimum bending radius for the most common heat tube sizes.

Table 1: Minimum heat tube bending radius

Tube nominal size	Min. center-line bend radius
25 mm (1" NPS)	125 mm (5")

5. PULL, SPLICE, AND JUNCTION BOX INSTALLATION

Note: Always keep the lids of pull, splice and junction boxes in place and closed during installation in order to prevent the entry of water and debris into the heat tube.

5.1 Pull and splice boxes

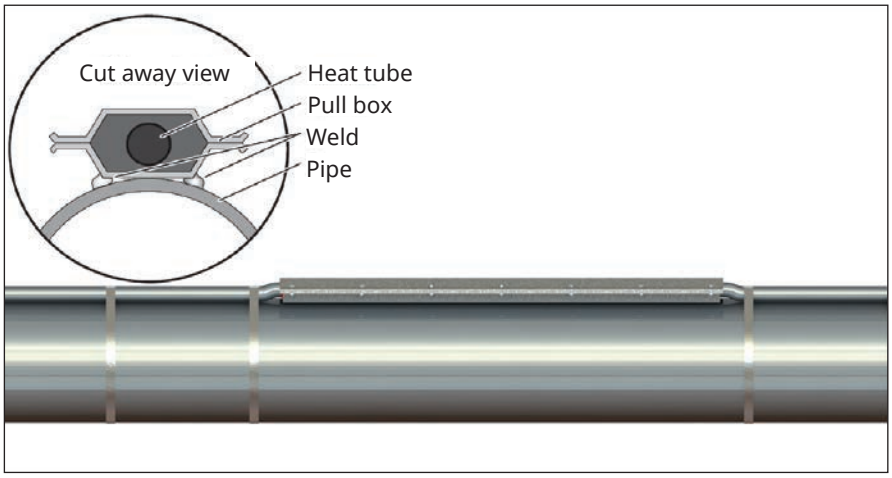

Figure 7: Typical pull box installation

⚠ Warning:
For painted enclosures in hazardous (explosive) locations, minimize the risk of electrostatic discharge of painted enclosures by conforming to the following recommendations:
a. Ensure that the explosive atmosphere is not present prior to contact or cleaning.
b. Make certain the enclosure is grounded to the pipe.
c. Avoid friction with surfaces. Only clean with wet cloth moistened with de-ionized water.
d. Avoid contact in low relative humidity environments.

Locate pull boxes as shown on the Chemelex project drawings for the STS system. The boxes are intended to fit under the thermal insulation, providing minimal heat loss. A “PULL BOX” or “SPLICE BOX” label should be permanently affixed to the outside of the insulation jacketing in a location where it can be readily seen by maintenance personnel. These labels are available from Chemelex.

All pull or splice boxes must have a permanent “HIGH VOLTAGE” warning label installed on the OUTSIDE of the insulation jacketing.

The heat tube must be welded to the pull boxes, as is done at heat tube couplings. Make sure that the heat tube ends are deburred and have an internal bevel. Ensure that the heat tube ends are fully inserted into the pull-box couplings. Full weld the heat tube to the coupling. Specific installation details are found on the Chemelex project drawings.

5.2 Junction boxes (power connection, jumper, and end termination)

Junction boxes are provided for making power connections, end terminations and jumper connections. These boxes are typically designed to provide access to the electrical connections inside without removal of thermal insulation, in order to facilitate easy preventative maintenance procedures. The exact size and configuration of these boxes will vary somewhat depending on the application. Refer to Chemelex specific drawings for further details and box locations. All junction boxes must be locally grounded using the grounding terminal provided on the outside of the box.

The heat tube must be welded to the box entry couplings, as is done at heat tube couplings. Make sure that the heat tube ends are deburred and have an internal bevel. Ensure that the tube ends do not extend more than 3 mm (⅛") past the inside end of the box entry coupling. Welding must be done on the OUTSIDE of the box, where shown on the drawings. No welding is allowed on the inside of the box.

It is typically required that a filler plate be installed between the heat tube and the pipeline, at the heat tube entry to the STS junction box. This is detailed on the Chemelex project drawings.

6. HEAT TUBE INSPECTION AND TESTING

After installing the heat tube, several tests must be performed. These tests are designed to ensure the electrical continuity, water tightness and physical quality of the installed tube. Performing these tests will ensure that the STS tracing wire can be installed without the risk of damage, and that the electrical current will be contained within the heat tube.

The STS Heat Tube Inspection Report form is provided at the end of this manual. Each heat tube section must be inspected and reported. Copies of completed forms must be available for the Chemelex Field Service engineer to review.

6.1 Heat tube pigging

Blow a jet line through the tube then pull the proper size conduit mandrel/scraper (or ball) through the tube. A cloth swab attached to the end of the scraper should be used to help clean and dry the tube. If the mandrel will not pass through the tube, locate the source of the problem and correct it. Common problems are typically linked to tube deformation at elbows and bends.

Table 2: Special Tools for Heat Tube Testing

Description	Item	Part No.
Heat tube ID scraper mandrel, 1"	STS-SCRAPER-25	302807-000

6.2 Air test

The tube must be air tested in order to verify water tightness and electrical continuity. In addition, failure to hold air pressure indicates a poor coupling weld, or a burn through in the welding of the heat tube. These problems may prevent the use of a jet line for wire pulling, and may ultimately result in premature electrical failure of the tracing system.

Plug one end of the tube section under test (typically, between two boxes), then pressurize the tube to a gauge pressure of 103.4 kPa/
1034 millibar/15 PSI. Hold a static pressure for at least 5 minutes. If the pressure will not hold, inspect the tube couplings and joints with soapy water to find the leak.

Note: Pull, splice, and junction boxes are not air tight. It will not be possible to include these boxes in the test section.

Note: Test plug dimensions should match the heat tube nominal size.

Table 3 contains a list of special tools that are required for air testing of the heat tube.

Table 3: Air Testing

Description	Item	Part No.
1" ported air test plug	STS-PATP-25	028081-000
1" bolt grip test plug	STS-BGTP-25	216999-000
1" ported air test plug, .97"-1"	STS-PATP-25-HV	T1250337

7. INSTALLATION AND TESTING OF STS TRACING WIRE

The STS-HV Tracing Wire is a critical element of the tracing system. It is of the utmost importance that the proper wire be used in each system. The conductor size, temperature and voltage ratings must be as specified on the Chemelex project specifications and drawings. Failure to use the proper wire will result in unacceptable system performance and may result in unsafe operating conditions or system failure. Use only Chemelex STS-HV tracing wire.

Table 4 provides a listing of special tools that may be required for installation of the STS-HV wire and splices.

Table 4: Special Tools Required for STS Wire and Splice Installation

Description	Item	Part No.
STS-HV Installation Tool Kit	STS-HV-TOOL-KIT	1244-022620
STS-HV Splice Kit	STS-HV-SPLICE-KIT	1244-022517
STS-HV Power Termination Kit	STS-HV-POWER-TERM-KIT	1244-022516
STS-HV End Termination Kit	STS-HV-END-TERM-KIT	1244-022791
Grip for cable	STS-CABLE-GRIP	T1250156 & 157 (tabulated)
Cable break-away	STS-BREAK-AWAY SWIVEL	T1250158
Cable break-away pins	STS-BREAK-AWAY PINS	T1250159 & 160 (tabulated)
Rope for pulling cable	STS-2400'-PULL ROPE	T0014389

7.1 Wire pulling

⚠ **Important:**
Once the wire is installed, no further welding may be performed on the carrier pipe or heat tube, as damage to the wire will result. Ensure that all pipeline and heat tube inspection and testing has been completed and accepted prior to wire installation.

⚠ **Important:**
Be careful to obey any maximum exposure temperature limits that apply to the system. Steam cleaning, or any other high temperature pre-commissioning operations that may be required and would potentially exceed the exposure temperature limits, should be performed prior to installing the STS wire.

⚠ **Warning:**
For painted enclosures in hazardous (explosive) locations, minimize the risk of electrostatic discharge of painted enclosures by conforming to the following recommendations.
a. Ensure that the explosive atmosphere is not present prior to contact or cleaning.
b. Make certain the enclosure is grounded to the pipe.
c. Avoid friction with surfaces. Only clean with wet cloth moistened with de-ionized water.
d. Avoid contact in low relative humidity environments.

For wire pulling, station people at the payoff reel and intermediate pull boxes as required. DO NOT use lubricants since they may break down when exposed to higher temperatures and cause degradation of the heat tube or wire. Do not, under any circumstances, exceed the maximum pulling forces listed in Table 5. This can be accomplished by use of a breakaway device.

Table 5: Maximum Wire Pulling Tension

Wire Gauge	Maximum Pulling Force	Maximum Pulled Length
21 mm^2 (4 AWG)	90 kg (200 lb)	500 m (1640 ft)

During pulling, be sure to use an appropriate reel stand and arbor. Manually pull the wire off the reel in order to maintain slack as the wire feeds into the tube. Guide the wire carefully into the heat tube. Avoid dragging the wire across sharp or abrasive edges. Visually inspect the wire as it pays off the reel to ensure that no damage has occurred. If damage to the wire is found, stop pulling and report the condition to Chemelex.

DO NOT install any damaged STS tracing wire.

7.2 Wire splicing and termination

STS-HV wire splices are to be made in STS-HV pull boxes or STS-HV jumper boxes. Be sure to follow the splice installation instructions provided with each STS-HV Splice Kit.

To ensure high reliability STS tracing wire splices and terminations, Chemelex requires the use of specialty connectors, lugs and components. Use only components provided with the STS-HV splice or power termination kit. Do not substitute components! Additional kits may be re-ordered from Chemelex if necessary.

In order to ensure high quality STS-HV tracing wire splices and terminations, use only the splice and power termination kits listed in Table 4 and be sure to follow the specific splice and power termination instructions provided in the documents referenced in Table 6 below, which are also included with every splice and power termination kit.

Be sure to follow the specific splice and termination instructions provided in the documents referenced in Table 6 below. These documents are also included with every splice and power termination kit.

Table 6: STS-HV Splice and Power Termination Instructions

Description	Document Number
STS-HV Splice Installation Instructions	H60894
STS-HV Splice Installation Template Sheet	H60895
STS-HV Power Termination Installation Instructions	H60896
STS-HV Power Termination Installation Template Sheet	H60897
STS-HV End Termination Installation Instructions	H61694

7.3 Wire testing

⚠ **Warning:** Shock Hazard
Very high test voltages are used. Take appropriate measures to assure that no personnel can come into contact with the STS wire while it is under test!

⚠ **Warning:** Shock Hazard
The STS wire and heat tube act like a large capacitor and will hold the test voltage for a considerable length of time after turning the test equipment off. Be sure to leave the test equipment connected and off until the residual charge has dissipated and the voltage has returned completely to ZERO.

A dielectric test must be performed on the STS tracing wire after pulling and splicing, but before terminating. It may be helpful to test the wire after each section is pulled so that any faults can be more easily identified. In any event, a final dielectric test must be performed at the voltages listed in Table 7 for each corresponding wire type.

A STS Tracing Wire and Splice Inspection and Test Report form is provided at the end of this manual. Each STS wire section must be inspected, tested and reported. Copies of the completed forms must be available for the Chemelex Field Service engineer to review. A final, pre-commissioning test must also be performed and witnessed by the Chemelex Field Service Engineer.

Table 7: STS Wire Test Voltages and durations

STS Wire Voltage Rating	STS Wire Type	Test Voltage (Acceptance)	Test Voltage (Installation & Maintenance)
10000 VAC	STS-HV	24 kVac VLF, 30 minutes	18 kVac VLF, 15 minutes

VLF Test Procedure

1. At each end of the test section, prepare the cable as if preparing for a termination by following the procedure in the Power Termination Installation Instructions, steps 1–6 only. At the end where the VLF hipot is positioned for the test, continue with steps 7–9 in the Power Termination Installation Instructions.
2. At the far end from the VLF hipot fix the cable so that the exposed end is kept clean, dry, and at least 250 mm from any conductive surface. Place a safety barrier a distance of at least 1 m from the wire, all around the wire end and position safety personnel outside the barrier.
3. At the VLF hipot location, connect the ground lead of the VLF hipot to the heat tube, then connect the high voltage lead of the VLF hipot to the conductor. Place a safety barrier a distance of at least 1 m from the wire, all around the wire end.
4. Setup the VLF hipot for the appropriate test voltage and duration and perform the test. Record all measured parameters on the "STS HEAT TRACING WIRE AND SPLICE INSPECTION REPORT".
5. After the test is complete, turn off the test voltage and allow the STS conductor to remain grounded via the VLF hipot until the voltage has returned to 0 for a period of at least 5 minutes before disconnecting the test leads or entering the safety barrier zones.

Note: Refer to the Chemelex project specific Operations and Maintenance manual for troubleshooting guidelines.

8. STS ELECTRICAL EQUIPMENT INSTALLATION AND TESTING

STS electrical equipment such as switchgear and control panels, transformers, and load balancing units must be installed, inspected, and tested on site as directed by the equipment supplier or in Chemelex' project specific Operation and Maintenance Manual.

9. STS HEAT TUBE INSPECTION RECORD

Chemelex Industrial Heat Tracing Solutions

Report Number: _____

Project Number: _____

Revision Number: _____

Project Name: _____

Drawing Numbers: _____

Pipe Spool Numbers: _____

Inspection Item		Test Criteria	RESULT		Remarks
			Accept	Reject	
1	Heat Tube Material	A-106 SMLS Grade B			
2	Heat Tube Size	1" schedule 40			
3	Heat Tube Cutting Length	Per Drawings			
4	Heat Tube End de-burring	No Burrs, Slight Inside Bevel			
5	Heat Tube Coupling	Centered and Welded			
6	Heat Tube Attachment dimensions	Per Drawings			
7	Heat Tube pigging	Mandrel/Scraper (or Ball) Must Pass Freely			
8	5 minute Static Air Test	1034 mb/103.4 kPa/15 PSIG			
9	Close box or cap tube end				

Comments:

Performed by: _____ Sign/Date

Witnessed by: _____ Sign/Date

Approved by: _____ Sign/Date

10. STS HEAT TRACING WIRE AND SPLICE INSPECTION REPORT

Chemelex Industrial Heat Tracing Solutions

Report Number: _____

Revision Number: _____

Project Number: _____

Project Name: _____

Drawing Numbers: _____

Pull box Ref. Numbers: _____

Circuit Number: _____

Length of wire under test: _____ km

	Inspection Item	Test Criteria	RESULT		Remarks
			Accept	Reject	
1	Confirm STS wire type and size	Chemelex drawings			(Record wire markings here)
2	Confirm proper splice materials and procedure used	Per Drawings			
3	Prepare wire ends and VLF hipot connections	1. Prepare cable ends (see section 7.3) 2. SAFETY CHECK: Check clearances and safety barriers at both ends of the cable under test			
4	Apply VLF test voltage with Trip On Arc setting ON	(Check the appropriate box) Preliminary or Maintenance Test: ☐ 18 kV for 15 minutes Final Acceptance Test: ☐ 24 kV for 30 minutes			IR _____ MΩ/GΩ Capacitance _____ µF/nF Current _____ µA/mA Frequency _____ Hz
5	⚠ Turn off test voltage and allow the STS conductor to remain grounded via the VLF hipot until the voltage has returned to 0 for a period of at least 5 minutes before disconnecting the test leads or entering the safety barrier zones.				
6	Is Insulation Acceptable?	Did the VLF hipot detect an arc? Per-unit IR = Measured IR*length under test (km) Per-unit Capacitance = Measured Capacitance/length under test (km)/1000			Reject if arc detected Minimum acceptable per-unit insulation resistance is 10 MΩ*km Minimum acceptable per-unit Capacitance = 230 nF/km Maximum acceptable per-unit Capacitance = 260 nF/km
7	Close boxes				

Performed by: _____ Sign/Date

Witnessed by: _____ Sign/Date

Approved by: _____ Sign/Date

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