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شرکت ملی گاز ایران

مدیریت پژوهش و فناوری

امور تدوین استانداردها

IGS

مشخصات فنی خرید

سیستم غلاف انقباضی حرارتی برای دمای تا ۸۰ درجه سانتیگراد

Heat Shrinkable Sleeve System (Hot Melt Adhesive) for
Service Temperature up to 80 C.



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شرکت ملی گاز ایران



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باسلام،

به استحضار می‌رساند در جلسه ۱۷۸۰ مورخ ۱۳۹۷/۳/۶ هیأت مدیره، نامه شماره گ/۹/۰۰۰/۲۰۴۲۴ مورخ ۹۷/۲/۲۵ مدیر پژوهش و فناوری در مورد تصویب نهایی استاندارد به شرح زیر مطرح و مورد تصویب قرار گرفت:

۱. دستورالعمل بازرسی رله‌های حفاظتی کلیدهای هوایی

IGS-I-EL-003(0)

۲. دستورالعمل بازرسی رله‌های حفاظتی

IGS-I-EL-002(0)

۳. سیستم غلاف انقباضی حرارتی برای دمای تا ۸۰ درجه سانتیگراد

IGS-M-TP-014-3(3)

این مصوبه در حکم مصوبه مجمع عمومی شرکت‌های تابعه محسوب و برای کلیه شرکت‌های تابعه لازم الاجرا می‌باشد.

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FOREWORD

This standard is intended to be mainly used by NIGC and contractors and has been prepared on interpretation recognized standards, technical documents, knowledge, backgrounds and experiences in gas industries at national and international levels.

Iranian gas standards (IGS) are prepared, reviewed and amended by technical standard committees within NIGC Standardization division and submitted to the NIGC's "STANDARDS COUNCIL" for approval.

IGS Standards are subject to revision, amendment or withdrawal, if required, thus the latest edition of IGS shall be checked/inquired by NIGC users.

This standard must not be modified or altered by the end users within NIGC and her contractors. Any deviation from normative references and/or well known manufacturers specifications must be reported to Standardization division.

Any comments from concerned parties on NIGC distributed IGS are welcome to technical standards committees and will receive serious attention and consideration should a revision to standards is recommended .

GENERAL DEFINITIONS

Throughout this standard the following definitions, where applicable, should be followed:

- 1- "STANDARDIZATION DIV." has been organized to deal with all aspects of industrial standards in NIGC. There for, all queries for clarification or amendments are requested to be directed to mentioned div.
- 2- "COMPANY": refers to national Iranian gas company.
- 3- "SUPPLIER": refers to a firm who will supply the service, equipment or material to IGS specification whether as the prime producer or manufacturer or a trading firm.
- 4- "SHALL": is used where a provision is mandatory.
- 5- "SHOULD": is used where a provision is advised only.
- 6- "MAY": is used where a provision is completely discretionary.

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1. Scope

This standard specification covers the minimum requirements of high temperature hot melt type heat shrinkable sleeve used for external corrosion protection on the field girth weld areas of line pipes.

Note:

The materials for field repair of main coating (melt stick, filler mastic and repair patch) are covered in Annex A.

2. References

Throughout this standard specification , the following standards and codes are referred to , the edition of them , that are in effect at the time of issues of this standard specification shall , to the extent specified herein , form part of this standard specification . The applicability of changes in standards and codes that occur after the date of standards that referred shall be mutually agreed upon by the purchaser and manufacturer or supplier.

2.1 Normative References

IGS-C-TP-010(1) , " 3Layer polyethylene coating system"

ASTM D 570 (2010), "Test method for water absorption of plastics"

ASTM D 638 (2014) , "Test method for tensile properties of plastics"

ASTM D 1603 (2014), "Standard test method for carbon black content in olefin plastic"

ASTM D 1000 (2017) , "Test Method for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications"

ASTM D 2240 (2015) , "Test method for rubber property-durometer hardness"

ASTM E 28 (2014) , "Test method for softening point of resins derived from naval stores by Ring-and-Ball apparatus"

ISO 6964 (2006) , "Determination of carbon black content by calcination and pyrolysis Test method and basic specification"

ISO 18553 (2014), "Method for the assessment of the degree of pigment or carbon black dispersion in polyolefin pipes, fittings and compounds"

ISO 21809-3 (2016), "Petroleum and Natural Gas Industries External Coating – Part 3: Field Joint Coatings"

2.2 Informative References

BS EN 12068 (1999) , "Cathodic protection-External organic coatings for the corrosion protection of buried or immersed steel pipelines used in conjunction with cathodic protection-Tapes and shrinkable materials"

3. Terms and Definitions

3.1 Heat Shrinkable Sleeve

Coating that will reduce in dimensions from an expanded size to a predetermined size by the application of heat.

3.2 Hot Melt Adhesive

A family of adhesive based on semi-crystalline polymers.

3.3 Coating Repair Material

Pre-manufactured patches, fillers, etc., compatible with and made from similar materials as the heat shrinkable sleeve.

3.4 Coating System

The complete number and types of coats applied to a substrate in a predetermined order.

3.5 Filler Material

Compatible material used under a heat shrinkable sleeve or repair patch to fill voids if any.

3.6 Factory Coating (mill coating)

Coating applied to pipe length in a factory or yard before delivery.

3.7 Cut back

The length of pipe left uncoated at each end for joining purpose (e.g.welding)

3.8 Adhesion Strength

The force necessary to remove the coating from a prescribed surface when measured in Accordance with specific conditions of test.

3.9 Application Procedure Specification (APS)

Document describing procedures, methods, equipment and tools used for coating application.

4. General Characteristics

1- The hot melt type heat shrinkable sleeve shall consist of a hot melt type adhesive coated wraparound sleeve.

2- The black backing layer of the heat shrinkable sleeve shall be irradiation (electron beam) cross linked high density poly ethylene.

3- The heat shrinkable Polyethylene coating shall be extruded, crosslinked, and then expanded to the required dimensions.

4- The product shall be homogeneous and essentially free of flaws, defects, pinholes, bubbles seams, cracks, or inclusions.

5- The thickness of the system shall be measured at four positions around the circumference of the pipe, with 4 measurements taken at each position, and shall be average 2.9 mm.

6- The black polyethylene backing of the heat shrinkable sleeve supplied with a quality assurance indicator system that changes when heated to a sufficient temperature during installation.

7- This type of heat shrinkable coating system shall compose of a two component solvent free (100% solid) liquid epoxy primer, a heat shrinkable sleeve and a closure patch. The hot melt type heat shrinkable sleeve shall meet the requirements of Table 1.

8- The liquid applied epoxy primer shall be a two pack product, formulated for use with the offered heat shrinkable sleeve, suitable for hand application and be completely suitable for use at the design temperature of the pipeline.

Note: Each batch of liquid applied epoxy primer shall be accompanied by a certificate (DIN 50049.3.1B or equivalent) stating in Annex C have been carried out on every batch and results are in accordance with the manufacturer`s product specifications.

9- The closure patch shall consist of irradiation cross linked high density polyethylene and proven to prevent the more than 1 cm of slippage between the two sides of heat shrinkable sleeve during application.

4.1 Accessories

The following accessories shall be ordered with the heat shrinkable sleeves in accordance with the manufacturer installation instructions:

Applicator pad
Mixing stick
Mixing cups
Epoxy dosing pumps
Digital thermometer with probes
Hand roller

Table 1 – Hot melt base heat shrinkable sleeve properties

Property		Test temp.	Unit	Polyethylene (T max ≤ 80 °C)	Test method	Manufacture qualification on Test	Manufacture batch Certificate
1	Backing thickness (as supplied) , min	—	mm	1	ASTM D 1000	yes	yes
2	Adhesive thickness (as supplied), min	—	mm	1.5	ASTM D 1000	yes	yes
3	Total thickness (as installed) average	—	mm	≥2.9	ASTM D 1000	yes	yes
4	Holiday detection at 5 kV/mm + 5 kV(see Note 3)	—	—	No holiday	ISO21809-3 Annex C	-	-
5	Impact resistance (holiday detection at 5 kV/mm + 5 kV)	23 °C	J/m m	≥7	ISO21809-3 Annex D	yes	yes
6	Indentation resistance at Pressure 10,0 N/mm ² : Residual thickness	T max	mm	≥0,6	ISO21809-3 Annex E	yes	yes
7	Cathodic disbondment	23 °C at 28 days	mm	≤5,0	ISO21809-3 Annex G	yes*	-
		65°C, 48h	mm	≤5,0		-	yes
		T max limited to 80 °C at 28 days	mm	≤10		yes*	-
8	Peel strength at 10 mm/min to pipe surface and to polyolefin plant coating	23 °C	N/m m	≥5,0	ISO21809-3 H	yes*	yes
		T max (80°C)	N/m m	≥0,30	ISO21809-3 H.1	yes*	yes
9	Peel strength at 10 mm/min to pipe surface plant coating after 100 day hot-water immersion test at T max limited as per Annex I	23 °C	P100 /P0	≥0,75	ISO21809-3 Annex I And Annex H	yes*	-
10	Carbon black content	—	%	2-2.5	ISO 6964 or ASTM D1603	yes	yes
11	Carbon black dispersion	—	Grade	≤ 3	ISO 18553	yes	-

Table 1 (Continue)

Property		Test temp.	Unit	Polyethylene (T max ≤ 80 °C)	Test method	Manufacture qualification on Test	Manufacture batch Certificate
12	Lap shear strength at 10 mm/min	23 °C	N/m ²	≥3,0	ISO21809-3 Annex J	yes	yes
		T max (80°C)	N/m ²	≥0,20			
13	Thermal ageing resistance(aged at T max + 20 °C)	23 °C	—	≥0,75	ISO21809-3 Annex M	yes*	-
	— Elongation at break E100/E70)						
	— Peel strength to pipe surface (P100/P70)	—	—	≥0,75			

***Note 1: At the discretion of the purchaser, the qualification tests may be waived, provided that the certificates and the results of tests carried out at a reputable third-party test laboratory, not exceeding two years from the date of tests, submitted by the manufacturer/supplier and approved by the purchaser.**

***Note 2: The acceptable peeling test in the site is Controlled rate of peel — Force to be recorded. The average peel strength shall meet the requirements as specified in the table 1 and no single recorded peeling value shall be more than 30 % below the specified value. At least 50% of peel surface shall be cohesive.**

***Note 3: The entire surface of the coated field joint shall be checked for holidays or other discontinuities at a voltage of 5 kV/mm + 5 kV at a maximum of 25 kV.**

5. Documentation

The manufacturer/supplier shall provide sufficient information to identify the coating system and shall supply as a minimum requirement, the technical information of the coating components as follows:

A: ISO/TS 29001 "CERTIFICATION" for "Design, Manufacturing and Quality control" of offered coating system for "pipeline corrosion protection" issued by an internationally recognized body.

B : Certificate and approval test report from an internationally well known certifying body (shall be approved by Technical & Industrial Research Laboratories of NIGC) for the offered coating system as stress class C and maximum operating temperature of up to 80 °C and the compatibility with this standard specification .

Note: for Iranian manufacturer other certificates from recognized certifying body shall be approved by Technical & Industrial Research Laboratories of NIGC.

C: Original technical catalogues, manufacturing product data sheet and application procedure recommendation and guidelines (installation instructions) for all of the items to be offered.

D: Material Safety Data Sheet (MSDS).

E: Filled, signed and stamped data sheets stating in Annex B, Annex C and Annex D.

6. Quality Assurance

Manufacturer shall operate an effective, documented quality system based on the relevant part of the ISO/TS 29001 and maintain records identifying the product, date of manufacturing, batch numbers and all results of inspection and testing.

7. Inspection and Testing

The manufacturer shall set up and maintain such quality and inspection system as to ensure the material supplied, comply with all aspect of the requirements of this standard specification.

The manufacturer shall furnish the purchaser or its nominated inspector an overall compliance certificate accompanied with all in-production quality control test results for review. These documents and test results shall be traceable with regard to the batch number of each item.

The purchaser or his nominated inspector may inspect a part or the whole of the materials at the manufacturer's works during manufacture and prior to packing and may witness any inspections and tests as called for, by this standard specification.

Purchaser's inspector shall have free access to the manufacturer's works at any time during manufacturing.

The manufacturer shall provide all means necessary for carrying out all inspections and tests as required by this standard specification.

Random sampling proportional to the quantity of each item and frequency of inspections and tests as required by this standard specification shall be at the discretion of the inspector.

If a sample is rejected in any inspection or test, double sampling shall be carried out, in case of any rejection in new samples, all materials represented by such sampling shall be rejected.

Inspection or tests carried out by the purchaser's inspector, in no way relieves the manufacturer/supplier of his responsibilities and liabilities under the conditions, terms and specification of this standard specification.

8. Packaging

The heat shrinkable sleeve , epoxy primer and accessories shall be packaged in strong cartons then located on heavy wooden pallet with a light plate on top of the steel drums and carton ; tightly on sides with plastic cover and finally put them into a 20/40 ft³ standard container that ensure acceptance and safe delivery to their destination .

8.1 The weight of each container with the consigns should not be more than 22 MT (metric ton).

8.2 The capacity of steel drums (epoxy primer) shall not be more than 20 liter.

8.3 Each heat shrinkable coating item shall be packaged to prevent adherence to the packaging material or the container.

8.4 Each container of coating material shall contain application instruction.

8.5 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.

8.6 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.

9. Marking

The carton packaging shall be plainly marked with the following information.

Name	High temperature hot melt type heat shrinkable sleeve
Specification	IGS-M-TP-014-3 (last version)
Order No.	
MESC No.	
Type and trade name of material	
Dimensions (Expanded and Recovered)	
Maximum temperature resistance , °C	
Application temperature , °C	
Storage conditions	
Color	
Batch No.	
Stock No.	
Date of manufacture	
Shelf life	
Minimum shelf life (epoxy primer)	12 months from the date of delivery
Expire Date	
Quantity of material in container	
Information and warning , if required	
Manufacturer name and address	

10. Instruction for Use

10.1 The hot melt type heat shrinkable sleeve shall be used for the pipeline projects that has been factory coated with three layer extruded polyethylene coating system

10.2 The hot melt type heat shrinkable sleeve shall be used for the pipeline projects with the maximum operating temperature of up to 80 0C.

10.3 Surface preparation shall be carried out according to the APS. The edges of the plant coating shall be beveled and the plant coating shall be roughened for the minimum length according to the overlap on plant coating. The area being coated shall be cleaned by abrasive blast-cleaning as described in ISO 8504-2 to a minimum grade SA 2½ according to ISO 8501-1. The profile/roughness shall be in accordance with the manufacturer's application instructions. Dust contamination shall be grade 2 or better, measured in accordance with ISO 8502-3.

10.4 For each field joint, only one sleeve shall be applied. The width of heat shrinkable sleeve shall be equal to max. Two cutback length (mm) + (200±10mm). (As per IGS-C-TP-010)

10.5 The time difference between the application of HSS coating and pipeline lowering shall not be longer than ten days.

10.6 The specific application procedure shall be described by the manufacturer and furnished to the purchaser with each batch of product.

"ANNEX A"

Repair Materials

The repair materials consist of the following components:

A) Repair patch

The repair patch shall be an irradiated (electron beam) cross linked high density polyethylene backing coated internally with a high temperature , high melting point semi crystalline thermoplastic adhesive , which is applied over the filler mastic covering the damaged area .

The backing layer of repair patch shall be thermally stabilized and ultra violet resistance.

The repair patch shall meet the requirements mentioned in Table A-1.

B) Filler mastic

The filler mastic shall be a rubber extended semi crystalline adhesive in according with the following physical properties:

- Lap shear strength at 23 °C , min : 0.25 N/mm² (ISO 21809-3 Annex J)
- Softening point, min: 100 °C (ASTM E 28)

C) PE melts stick

The melt stick shall be from the same hot melt adhesive used for manufacturing of heat shrinkable sleeves.

Table A-1. Physical properties of repair patch material

PROPERTIES		REQUIREMENTS	UNITS	TEST METHODS
ADHESIVE	Thickness (as supplied), min	0.65	mm	ASTM D 1000
	Softening point, min	100	°C	ASTM E 28
	Lap shear at 80 °C, min	0.06	N/mm ²	ISO 21809-3 (Annex J)
BACKING	Thickness (as supplied), min	0.75	mm	ASTM D 1000
	Tensile strength, min	17	MPa	ASTM D 638
	Elongation at break, min	400	%	ASTM D 638
	Hardness, min	50	Shore D	ASTM D 2240
PATCH	Impact resistance at 23 °C, min	7	J/mm	ISO 21809-3 (Annex D)
	Indentation resistance at 80 °C	10	N/mm ²	ISO 21809-3 (Annex E)
	Peel strength to pipe surface and to factory coating, min - at 23 °C - at 80 °C	3 0.2	N/mm N/mm	ISO 21809-3 (Annex H)
	Water absorption, max	0.05	%	ASTM D 570

"ANNEX B"
Data Sheet for Hot Melt Base Heat Shrinkable Sleeve

Manufacturer's name and address	
Product	
Product designation	

ITEMS	ELEMENTS	ACTUAL AND REPRODUCABLE DATA	UNITS	TEST METHODS	REMARK
1	Backing thickness (as supplied) , min				
2	Adhesive thickness (as supplied), min				
3	Total thickness (as installed) average				
4	Holiday detection at 5 kV/mm + 5 kV				
5	Impact resistance (holiday detection at 5 kV/mm + 5 kV)				
6	Indentation resistance at Pressure 10,0 N/mm ² : Residual thickness				
7	Cathodic disbondment				
8	Peel strength @ 10 mm/min to pipe surface and to factory coating after 28 days hot water soak test at 80 °C				
9	Peel strength at 10 mm/min to pipe surface plant coating after 100 day hot-water immersion test at T max limited as per Annex				
10	Carbon black content				
11	Carbon black dispersion				
12	Lap shear strength at 10 mm/min				
13	Thermal ageing resistance (aged at T max + 20 °C) — Elongation at break E100/E70) — Peel strength to pipe surface (P100/P70)				

NOTES:

1. This data sheet shall be filled, signed, and stamped by manufacturer/supplier.
2. Any deviation from this standard specification shall clearly be specified by manufacturer/supplier.

"ANNEX C"
Data Sheet for Two Component Epoxy Primer

Manufacturer's name and address	
Product	
Product designation	

ITEMS	ELEMENTS	ACTUAL AND REPRODUCTION DATA	UNITS	TEST METHODS	REMARK
1	Density of part A				
2	Density of part B				
3	Pot life at 23 °C				
4	Pot life at 50 °C				
5	Mixing ratio				

NOTES:

1. This data sheet shall be filled, signed, and stamped by manufacturer/supplier.
2. Any deviation from this standard specification shall clearly be specified by manufacturer/supplier.

"ANNEX D"
Data Sheet for Repair Patch Material

Manufacturer's name and address	
Product	
Product designation	

PROPERTIES		ACTUAL AND REPRODUCIBLE DATA	UNITS	TEST METHODS	REMARK
ADHESIVE	Thickness (as supplied), min				
	Softening point, min				
	Lap shear at 80 °C, min				
BACKING PATCH	Thickness (as supplied), min				
	Tensile strength, min				
	Elongation at break, min				
	Hardness, min				
	Impact resistance at 23 °C, min				
ADHESIVE	Indentation resistance at 80 °C				
	Peel strength to pipe surface and to factory coating, min - at 23 °C - at 80 °C				
	Water absorption, max				
	Thickness (as supplied), min				
	Softening point, min				
	Lap shear at 80 °C, min				

NOTES:

1. This data sheet shall be filled, signed, and stamped by manufacturer/supplier.
2. Any deviation from this standard specification shall clearly be specified by manufacturer/supplier.