

IGS-C-TP-014-9(0)

Nov.2021

Approved

مصوب



شرکت ملی گاز ایران
مدیریت پژوهش و فناوری
امور تدوین استانداردها

IGS

دستورالعمل

سیستم پوششی غیر کریستالی پایه پلی الفینی با ویسکوزیته پایین (ویسکوالاستیک) برای محافظت از خوردگی خارجی و همچنین تعویض و بازسازی پوشش خطوط لوله فلزی مدفون

Non-crystalline low-viscosity polyolefin based coating system(visco-elastic) used for external corrosion protection and rehabilitation of buried pipe lines



تاریخ: ۱۴۰۰/۰۹/۱۶

شماره: گ.د/۰/۵۹۲/۰-۲۰۶۴۴



شرکت ملی گاز ایران



دفتر مدیرعامل

ابلاغ مصوبه هیأت مدیره

مدیر محترم پژوهش و فناوری

باسلام،

به استحضار می‌رساند در جلسه ۱۹۴۸ مورخ ۱۴۰۰/۰۹/۰۱ هیأت مدیره، نامه شماره گ.۱۰۶۶۱۷/۰۰۰/۹ مورخ ۱۴۰۰/۰۸/۲۴ مدیر پژوهش و فناوری در مورد تصویب نهایی مقررات فنی شرکت ملی گاز ایران به شرح زیر مطرح و مورد تصویب قرار گرفت.

۱- مشخصات فنی خرید ماده بودار کننده گاز طبیعی IGS-M-CH-038(2)

۲- دستورالعمل سیستم پوششی غیر کریستالی پایه پلی الفینی با ویسکوزیته پایین (ویسکوالاستیک) برای محافظت از خوردگی خارجی سرجوش ها ، سه راه ها ، اتصالات، شیرها، خم ها، فلنج ها و همچنین تعویض و بازسازی پوشش خطوط لوله فلزی مدفون

IGS-C-TP-014-9(0)

۳- مشخصات فنی خرید اتصالات عایقی IGS-M-PL-006(4)

الهام ملکی

دبیر هیات مدیره

رونوشت: مدیرعامل محترم شرکت ملی گاز ایران و رئیس هیات مدیره

اعضای محترم هیات مدیره

مشاور و رئیس دفتر محترم مدیرعامل

سرپرست محترم امور حقوقی

رئیس محترم حسابرسی داخلی

سرپرست محترم امورمجامع

Foreword

This standard specification is intended to be mainly used by N.I.G.C. and contractors, and has been prepared base on interpretation of recognized standards and technical documents, as well as knowledge, backgrounds and experiences in gas industries at national and international levels.

Iranian Gas Specification (IGS) are prepared, reviewed and amended by technical standard committees within NIGC standardization division of research and technology management and submitted to "the standards council of NIGC" for approval.

IGSs are subjected to revision, amendment or withdrawal, if required, and thus the latest edition of IGS shall be checked / inquired by NIGC'S users.

This standard must not be modified or altered by NIGC employees or its contractors. Any deviation or conflicts between this specification and other applicable standards, codes, procedure or well-known manufacturer's specifications must be resolved in writing by the user or its representative through Manager, Engineering Department or standardization division of NIGC.

The technical standard committee welcomes comments and feedbacks from concerned or interested corporate and individuals about this standard, and may revise this document accordingly based on the received feedbacks.

General Definitions

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

- 1- "STANDARDIZATION DIV." is organized to deal with all aspects of industry standards in NIGC. Therefore, all enquiries for clarification or amendments are requested to be directed to mentioned division.
- 2- "COMPANY": refers to National Iranian Gas Company (NIGC).
- 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.

Website: <http://igs.nigc.ir>

E-mail: igs@nigc.ir

Contents

	Title	Page
1	SCOPE	4
2	Description of the coatings	4
3	Testing of the applied coating	5
4	Table 11 — Coating identification	5
5	Table 12 —Requirements for non-crystalline low-viscosity polyolefin based coatings	6
6	Table 13 — Data sheets of non-crystalline low-viscosity polyolefin compound	8
7	Table 14— Application instructions	8

Guidance for use of this specification:

The amendments/ supplements ISO 21809-3 2016 13 Non-crystalline low-viscosity polyolefin based coatings given in this specifications are directly equivalent sections or clauses in ISO 21809-3 all other Paragraphs which are not amended by this supplementary shall remain valid as Written. The following annotations, as specified hereunder, have been used at the Beginning of each paragraph to indicate the type of change made to that paragraph of ISO 21809-3

Sub. (Substitution) "The paragraph in ISO 21809-3 13 Non-crystalline low-viscosity polyolefin based coatings shall be deleted and replaced By the new paragraph in this supplementary"

Del. (Deletion) "The paragraph in ISO 21809-3 13 Non-crystalline low-viscosity polyolefin based coatings shall be deleted without any Replacement"

Add. (Addition) "The new paragraph with the new number shall be added to The relevant section of ISO 21809-3 13 Non-crystalline low-viscosity polyolefin based coatings "

Mod. (Modification) "Part of the clause or paragraph in ISO 21809-3 13 Non-crystalline low-viscosity polyolefin based coatings shall be modified and/or the new description and/or statement shall be added to that clause or paragraph as given in this supplementary".

1 SCOPE (add.)

This standard specification covers the minimum requirements of Non-crystalline low-viscosity polyolefin based coatings(visco-elastic) used for external corrosion protection on the joints, tees, fittings, valves, pipe bend, flanges and rehabilitation of buried pipe lines.

2 Normative references (add.)

-DEP 31.40.30.37 2013 External Field Joint and Rehabilitation Coating Systems for Line Pipe

13.2 Description of the coatings (Mod.)

Non-crystalline low-viscosity polyolefin based coatings consist of the following:

- a non-crystalline (fully amorphous) low-viscosity (non-crosslinked) non-reactive polyolefin (e.g. polyisobutylene, other polybutenes, or atactic polypropylene) based compound layer with a direct bond to the substrate, which can be reinforced by fabrics and/or be covered by a backing film;
- a polymeric outer wrap tape or sheet (FJC type 13A), or a heat shrinkable outer wrap material (FJC type 13B), or any other agreed material.

The purposes of the compound are to prevent corrosion of the steel surface and to prevent voids and repair small coating defects of the complete FJC.

The purposes of the outer wrap are to provide additional circumferential compression, accelerate the bond, support self-healing and provide additional mechanical protection for the coating system.

Additional mechanical protection can be used over the FJC to improve mechanical properties, that may be needed during transportation (e.g. when it travels over rollers on a lay-barge) and operation.

The non-crystalline low-viscosity polyolefin based compound is available in the following forms:

- tapes;
- wraparound sheets;
- pre-formed shapes;

Non-crystalline low-viscosity polyolefin based coatings can be divided into the following:

- 13A-1 and 13B-1 with a T_{max} not greater than 50 °C;
- 13A-2 and 13B-2 with a T_{max} not greater than 70 °C;
- 13A-3 and 13B-3 with a T_{max} not greater than 95 °C.

The T_{max} shall be stated in brackets.

A T_{max} higher than 95 °C can be agreed as long as the requirements of Table 12 are met.

NOTE: High temperature classes can require either more time or a higher substrate temperature to achieve the prescribed levels of bonding (cohesive separation mode and full coverage).

The T_{max} shall be defined in the APS in accordance with Table 11.

13.5 Testing of the applied coating

13.5.15 Self-Healing (add.)

The self-healing behavior of the coating system shall be tested at room temperature and at maximum design temperature in accordance with the test method described below. There shall be no holidays and the minimum coating thickness recovered in the defect shall be more than 0.6 mm when measured 24 h after preparing the artificial defect in the coating.

The self-healing performance of the coating shall be tested as follows:

The test sample shall be free of holidays when tested. A sample of coated pipe shall be taken of sufficient length and with approximately the same diameter as the production pipe. A 6 mm hole shall be drilled in the coating, by means of a flat-faced mill. The hole shall not penetrate more than 0.5 mm into the steel substrate.

Distance between the hole and any weld shall be at least 50 mm. For each test specimen, 3 holes shall be drilled at least 50 mm apart and at least 50 mm distance from any weld or pipe end. The self-healing test shall be performed at room temperature and at the maximum design temperature. The test specimen shall be kept at the specified temperature for 24 h. After this period the holes shall be inspected by holiday detection and the thickness in the hole shall be measured.

The test shall be considered passed if no holidays are present and the thickness in the hole is more than 0.6 mm. (shell DEP 31.40.30.37 2013 3.2.5.9 & 7.14)

Table 11 — Coating identification	
Property	
Coating trade name	
Type of FJC	
Maximum and minimum service temperature	
Form of non-crystalline low-viscosity polyolefin compound	
Types, number and thicknesses of layers	
Trade names of all layers	
Nominal thickness of complete coating	
Compatible plant coatings ^a	
a State all types of plant coating that have been tested successfully with the coating.	

Table 12 — Requirements for non-crystalline low-viscosity polyolefin based coatings (Types 13A and 13B) (sub.)						
Property		Test temp.	Units	Requirements		Test method
Minimum thickness		23 °C	mm	≥specified minimum value		Annex B
Glass transition temperature		—	°C	at least 20 °C below minimum application		ISO 11357-2
Crystallization temperature		—	°C	No evidence of crystallization		ISO 11357-3
Holiday detection at 5 kV/mm + 5 kV, max. 25 kV		-	-	No holiday		Annex C
Self-healing		23 °C		No holidays		13.5.15
Drip resistance		Tmax + 20 °C (minimum 80 °C)	-	No dripping of compound		Annex K
Adhesion test of reinforced compound with respect to steel and to plant coating before and after thermal ageing and before and after hot-water immersion, both for 100 days at Tmax + 20 °C		23 °C	N/mm	≥0,04	Cohesive separation mode Coverage ≥ 95 %	Annex H T (and M.3 and Annex I)
		Tmax		≥0,02		
Adhesion test of compound without reinforcement with respect to steel and to plant coating before and after thermal ageing and before and after hot-water immersion, both for 100 days at Tmax + 20 °C)		23 °C	-	The coating shall leave a film of compound on the substrate.		13.5.9 (and M.3 Tmax and Annex I)
		Tmax				
Lap shear resistance		23 °C	N/mm ²	≥0,004	Cohesive separation mode Coverage ≥95 %	Annex J
		Tmax		≥0,002		
Specific electrical insulation resistance	RS100	23 °C	Ω·m ²	≥108		Annex F
	RS100/RS70		-	≥0,8a		
a This requirement shall be fulfilled only if the specific electrical insulation resistance after 70 days is less than 10 times the requirement of the specific electrical insulation resistance after 100 days.						
Complete coating						
Impact resistance		23 °C	J	≥15		Annex D
Indentation resistance	FJC Type	23 °C and Tmax	N/mm ²	13A	13B	Annex E
	Test pressure			1.0	10.0	
	Residual thickness		mm	≥0,6		
Cathodic disbondment resistance at 28 days		23 °C and Tmax	mm	0 mm, no holiday		Annex G (and Annex C and 13.5.7)
Type 13A (Outer wrap — Polymeric tape)						
Peel strength of outer wrap layer to outer wrap layer	23 °C		N/mm	≥0,20		Annex L
	Tmax			≥0,02		
Peel strength to plant coating (if applicable, see 13.4.2)	23 °C		N/mm	≥1,0		Annex H
	Tmax			≥0,1		

Table 12 (continued)				
Property	Test temp.	Units	Requirements	Test method
Peel strength (P'100/P'0) outer layer to outer layer after hot water immersion for 100 days at Tmax, max. 95 °C.	23 °C	-	≥0,75	Annex L (and Annex I)
Peel strength (P100/P0) to plant coating (if applicable, see 13.4.2) after hot water immersion for 100 days at Tmax, max. 95 °C.	23 °C	-	≥0,75	Annex H (and Annex I)
Elastic modulus (E100/E0) after thermal ageing for 100 days at Tmax + 20 °C	23 °C	-	≥0,75	M.1 and ISO 527-2
Peel strength (P'100/P'0) outer wrap layer to outer wrap layer after thermal ageing for 100 days at Tmax + 20 °C	23 °C	-	≥0,50	M.2
Peel strength to plant coating (if applicable, see 13.4.2) after thermal ageing (P100/P0) for 100 days at Tmax + 20 °C	23 °C	-	≥0,75	M.3
Type 13B (Outer wrap — Heat-shrinkable material)				
Peel strength outer layer to outer layer	23 °C	N/mm	≥1,0	Annex L
	Tmax		≥0,1	
Peel strength to plant coating (if applicable, see 13.4.2)	23 °C	N/mm	≥1,0	Annex H
	Tmax		≥0,1	
Peel strength (P'100/P'0) outer layer to outer layer after hot water immersion for 100 days at Tmax, max. 95 °C	23 °C	-	≥0,75	Annex L (and Annex I)
Peel strength to plant coating (if applicable, see 13.4.2) after hot water immersion (P100/P0) for 100 days at Tmax, max. 95 °C	23 °C	-	≥0,75	Annex H (and Annex I)
Elastic modulus (E100/E0) after thermal ageing for 100 days at Tmax + 20 °C	23 °C	-	≥0,50	M.1 and ISO 527-2
Peel strength (P'100/P'0) outer layer to outer layer after thermal ageing for 100 days at Tmax + 20 °C	23 °C	-	≥0,75	M.2
Peel strength (P100/P0) to plant coating (P'100/P'0) (if applicable, see 13.4.2) after thermal ageing for 100 days at Tmax + 20 °C	23 °C	-	≥0,75	M.3

Table 13 — Data sheets of non-crystalline low-viscosity polyolefin compound

Property	Units	Test method
Trade name	-	-
Prefabricated compound ^a — generic type of non-crystalline low-viscosity polyolefin — generic type of reinforcement material	-	-
Colour	-	-
Nominal thickness of prefabricated compound	mm	ISO 4591/ ISO 4593
Density	g/cm ³	-
Maximum and minimum service temperature	°C	-
Storage conditions — temperature range (minimum/maximum)	°C	-
Shelf life at storage temperature	month	-
Self-healing	-	13.5.15

Data according to this data sheet shall be supplied for each coating component.

^a If applicable.

Table 14 — Application instructions

Property	Units
Ambient conditions — minimum temperature — maximum temperature — maximum relative humidity	°C °C %
Surface preparation of steel surface — surface cleanliness (ISO 8501-1)	-
Surface preparation of plant coating	-
Application of coating — method of application — surface temperature/dew point — material temperature	— °C °C
General — minimum thickness — overlap on plant coating (minimum and maximum) ^a — specific application instructions — repair procedures	mm mm — —

^a To be given for each compatible plant coating.