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شرکت ملی گازایران

مدیریت پژوهش و فنآوری

**امورتدوین استانداردها**

IGS

**مشخصات فنی خرید**

# نوار پلاستیکی خودممزوج۳لابرای سرجوشها وبازسازی خطوط لوله فلزی

# 3 Ply Co-Extruded Plastic Tape for Field Joint and Rehabilitation of Steel Pipeline

دفتر مدیرعامل

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# ابلاغ مصوبه هیأت مدیره

**به : مدیریت محترم پژوهش و فناوری**

**از : دبیر جلسات هیأت مدیره**

باسلام،

باستحضار میرساند در جلسه ۱۳۳۴ مورخ ۲۴/ ۶/ ۱۳۸۷ هیأت مدیره، نامه شماره گ۹/۷۴۸۷۸/۰۰۰ مورخ ۸۷/۶/۱۳ مدیر پژوهش و فناوری درمورد تصویب نهایی استاندارد IGS-M-TP-014-2-C(2)3PLY ارجاعی از مدیرعامل شرکت مطرح و تصویب شد.

ابراهیم رئیسی

رونوشت : مدیریت محترم عامل و قائم مقام رئیس هیأت مدیره.
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## Foreword

This standard specification cancels and replaces IGS-M-TP-014-2-C(1):2007 , part 2 , which has been technically revised and updated .
It intended to be mainly used by all divisions of NIGC and EPC contractors , and has been prepared on interpretation of 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 of research and technology management and submitted to Standard Council of NIGC for approval .
Iranian Gas Standard (IGS) are subjected to revision , amendment or withdrawal , if required, thus the latest edition of IGS shall be checked/inquired by NIGC users and EPC contractors .
Any comments from concerned parties or individuals on IGS standards are welcomed .

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## 1. SCOPE

**1.1.** This standard specification specifies the NIGC requirements concerning properties , and relevant test methods for 3Ply co-extruded (see clause 3) cold applied plastic tape as external anti-corrosion protection of field weld joint , fitting , and rehabilitation of steel pipeline main coating , by hand or hand applied machine application .
This standard specification cover the use of 3Ply co – extruded cold applied plastic tape (mechanical resistance class C) when the service temperature is within -10 to +50 °C .
The coating performance , test methods , and inspection shall be all in accordance with Table 1 .

**1.2.** Manufacturer/supplier shall provide all application instruction , safety data sheet , and guidelines require in practice on application .

## 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 (2007) 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

DIN 30672 (2000) **"**Tape and shrinkable materials for the corrosion protection of buried or underwater pipelines without cathodic protection for use at operating temperatures up to 50 °C**"**

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

ASTM D 149 (1997) **"**Standard test method for dielectric breakdown voltage and dielectric strength of solid electrical insulating materials at commercial power frequencies**"**

ASTM D 570 (1998) **"**Standard test method for water absorption of plastics**"**

ASTM D 870 (2002) **"**Standard practice for testing water resistance of coatings using water immersion**"**

ASTM D 1000 (1999) **"**Standard test method for pressure-sensitive adhesive – coated tapes used for electrical and electronic applications**"**

ISO 2811 (1997) **"**Paints and varnishes – Determination of density**"**

ISO 3251 (2003) **"**Paints and varnishes – Determination of non – volatile matter of paints , varnishes And binders for paints and varnishes**"**

ISO 9001 (2000) **"**Quality system – Model for quality assurance in design , development , production , installation and servicing**"**

**2.2. Informative References**

IGS-TP-014(0) (2004) , Part 2 , **"**3Ply tape for coating of field weld joint**"**

DIN 30672-1 (1991) **"**Corrosion protection wrapping tape and heat shrinkable sleeve**"**

## 3. TERMS AND DEFINITIONS

**3.1 3Ply**

Refer to the structure of one co-extruded tape system .

**3.2 Co – extrusion**

Two or more materials are extruded simultaneously from a single die , so they fuse together to form a single structure . Laminated tape system is not accepted .

**3.3 Self amalgamating (self fusing) :**

**3.3.1 Tape to tape**

Two layer of 3Ply tape system in overlap area fuse to itself at room temperature with only slight pressure and over the time according to related method . This fusing action works only if the overlap layers are of same chemical nature (butyl rubber – butyl rubber) .

**3.3.2 Within three individual ply**

Only achievable by co – extruded method of production .

## 4. REQUIREMENTS

The coating system consist of a primer and a 3Ply plastic tape with following general description :

**4.1 Primer**

It shall be fast drying , butyl rubber base and special formulated to be used with 3Ply tape system . The primer properties shall meet the requirements of Table 2 .

**4.2 3Ply Tape System**

It shoud consist of a polyethylene carrier film , coated on both sides with a plastic butyl rubber based compound in one co – extrusion process .

**4.3 The Tape Application System**

The tape shall be applied with 50% overlap on primed surface . It amalgamates at the overlap at ambient temperature to form a sleeve type coating .

**4.4 The Tape and the Coating System**

The properties shall meet the requirements of Table 1 .

## 5. TABLE 1 –3Ply Tape and Coating System Properties

| ITEMS | ELEMENTS | REQUIREMENTS | UNITS | TEST METHODS |
|---|---|---|---|---|
| **1** | Total thickness | 0.8 ± 0.05 | mm | ASTM D 1000 |
| **2** | Tensile strength , min | 100 | N/cm | Annex A EN 12068 |
| **3** | Elongation at break , min | 600 | % | Annex A EN 12068 |
| **4** | Peel strength to primed steel , min<br>- at 23 °C<br>- at 50 °C | <br>12<br>1.5 | N/cm | Annex C EN 12068 |
| **5** | Peel strength tape to tape , min<br>- at 23 °C<br>- at 50 °C | <br>24<br>3 | N/cm | Annex B EN 12068 |
| **6** | *Impact resistance at 23 °C , min | 15 | J | Annex H EN 12068 |
| **7** | *Cathodic disbondment resistance , max<br>- at 23 °C<br>- at 50 °C | <br>15<br>30 | mm | Annex K En 12068 |
| **8** | Dielectric strength , min | 30 | kV/mm | ASTM D 149 |
| **9** | Specific electrical insulation resistance , min | $10^8$ | $\Omega\ m^2$ | Annex J EN 12068 |
| **10** | Water absorption , 23 °C , max | 0.1 | % | ASTM D 570 |
| **11** | *Lap shear strength , at 50 °C , min | 0.05 | $N/mm^2$ | Annex D EN 12068 |
| **12** | Peel strength to pipe surface at 23 ºC after 28 days hot water immersion test at 50 ºC , min | 0.4 | N/mm | Annex B |
| **13** | Thermal ageing resistance ratio of<br>- Tape strength<br>- Elongation at break<br>- Peel strength layer to layer<br>- Peel strength to pipe surface | <br>$1.25 \geq S_{100}/S_0 \geq 0.75, S_{100}/S_{70} \geq 0.8$<br>$1.25 \geq E_{100}/E_0 \geq 0.75, E_{100}/E_{70} \geq 0.8$<br>$P_{100}/P_T \geq 0.75, P_{100}/P_{70} \geq 0.8$<br>$A_{100}/A_T \geq 0.75, A_{100}/A_{70} \geq 0.8$ | --- | Annex E EN 12068 |
| **14** | Indentation resistance at 50 °C<br>- Residual thickness<br>- Holiday detection | <br>≥ 0.6<br>pass | <br>mm<br>--- | Annex G EN 12068 |
| **15** | Saponification value carrier film and Adhesive , max | 25 | mg KOH/g | Annex L EN 12068 |
| **16** | Width | 4 , 6 , 9 | inch | --- |

*Shall be carried out with 4 layer of 3Ply tape .

## 6. TABLE 2 – Primer Properties

| ELEMENTS | REQUIREMENTS | UNITS | TEST METHODS |
|---|---|---|---|
| Solid content by weight , min | 25 | % | ISO 3251 |
| Density , min | 0.78 | g/cm3 | ISO 2811 |

## 7. PACKING

### 7.1 3Ply Plastic Tape

The tape shall be delivered in roll form . A removable Interleaf shall be incorporated against adhesive compound to prevent sticking of layers . Each roll shall be individually put in plastic bag . Rolls shall be suitably palletized and packed with plastic cover .

### 7.2 Primer

The primer shall be delivered in maximum 20 liters new steel drums .

## 8. DOCUMENTATION

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

a- ISO 9001: 2000 " CERTIFICATION" for "Design & Manufacturing" of offered tape coating system (tape and primer) for "pipeline corrosion protection" issued by an internationally recognized body .

b- Certificate and approval test report from an internationally well known certifying body (i.e. DVGW (Germany) and ADVANTICA (UK) for the offered coating system for maximum continuous operating temperature up to 50 $^{o}$C and the compatibility with this standard specification .

**Note :** Other certificates from recognized certifying body shall be approved by standard council of NIGC .

c- Original technical catalogues , manufacturing product data sheet and application procedure recommendation and guidelines .

d- Material Safety Data Sheet (MSDS) for primer .

## 9. QUALITY ASSURANCE

Manufacturer shall operate an effective , documented quality system based on the relevant part of the BS EN ISO 9001:2000 and maintain records identifying the product , date of manufacturing , batch numbers and all results of inspection and testing .

## 10. INSPECTION AND TESTING

The manufacturer 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 .

## 11. STORAGE LIFE

**11.1** The tape shall meet the requirements of clause 5 after storage for 24 months of delivery date , in a tightly covered container at temperatures between -10 to +35 $^{o}$C .
**11.2** The primer shall show no thickening , curdling , skinning , gelling , or hard caking after storage for 24 months , at normal condition , from date of delivery in a full , tightly covered container .

## 12. MARKING

### 12.1 3Ply Tape

**12.1.1** Each roll shall be legibly marked with the following information :
Product designation , the name of manufacturer , purchaser and any applicable precautionary markings .
The indent number , length , width of the roll and shall also be marked on the packages .
Storage in closed and dry place , must be marked with a red "double roof" symbol .
**12.1.2** Each container shall be plainly marked with the following information :
- Name and trademark of the manufacturer
- Product designation
- Quantity (number of rolls in container)
- Roll sizes
- Batch No.
- Date of manufacture
- Manufacturer's name and address

**12.2 Primer**

Each drum shall be legibly marked with the following information :

- Name and trade mark of the manufacturer
- Product designation
- Batch No.
- Application temperature
- Storage temperature
- Type of thinner (if applicable)
- Cleaning material
- Flash point
- Drying time
- Date of manufacture
- Quantity of primer in container
- Maximum storage temperature
- Manufacturer's name and address
- MSDS warning sticker
- Shelf life
- Date of manufacturing

## 13. ANNEX A (Normative) – Data Sheet for Co – Extruded 3Ply Cold Applied Plastic Tape

| | |
|---|---|
| **Manufacturer's name and address** | |
| **Product** | |
| **Product designation** | |
| **Mechanical resistance class** | |

| ITEMS | ELEMENTS | ACTUAL and REPRODUCEABLE DATA | UNITS | TEST METHODS | REMARK |
|---|---|---|---|---|---|
| **1** | Total thickness | | | | |
| **2** | Tensile strength | | | | |
| **3** | Elongation at break | | | | |
| **4** | Peel strength to primed steel :<br>- at 23 °C<br>- at 50 °C | | | | |
| **5** | Peel strength tape to tape :<br>- at 23 °C<br>- at 50 °C | | | | |
| **6** | Impact resistance at 23 °C | | | | |
| **7** | Cathodic disbondment resistance :<br>- at 23 °C<br>- at 50 °C | | | | |
| **8** | Dielectric strength | | | | |
| **9** | Specific electrical insulation resistan | | | | |
| **10** | Water absorption , 23 °C | | | | |
| **11** | Lap shear strength , at 50 °C | | | | |
| **12** | Peel strength to pipe surface at 23 º<br>28 days hot soak water test at 50 º | | | | |
| **13** | Thermal ageing resistance ratio of<br>- Tape strength<br>- Elongation at break<br>- Peel strength layer to layer<br>- Peel strength to pipe surface | | | | |
| **14** | Indentation resistance at 50 °C<br>- Residual thickness<br>- Holiday detection | | | | |
| **15** | Saponification value carrier film and | | | | |
| **16** | Width | | | | |
| **17** | Application temperature | | | | |
| **18** | Service temperature | | | | |

**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 .

## 14. ANNEX B (Normative) – Hot Water Immersion Test

### B.1 General

This test shall be carried out to assess the comparative resistance of FJC applied to the bare steel substrate and the plant–applied coating to loss of adhesion due to water immersion .

Unless otherwise specified , the test temperature shall be the maximum design temperature of the FJC with the following limitations .

If the maximum design temperature of the FJC to be tested exceeds $95^0$C , the test temperature shall be limited to $95^0$C .

The test temperature shall not be greater than the maximum design temperature of the plant coating.

### B.2 Equipment

The following equipment shall be required :

- oven controllable to within $3^0$C ;
- holiday detector ;
- 75 mm ± 3 mm interior diameter plastic cylinder , 150 mm long ;
- pointed sharp knife ;
- elastomeric adhesive , e.g. silicone sealant ;
- small hacksaw blade, "Junior" type or similar .

### B.3 Sample preparation

#### B.3.1 Laboratory prepared samples

**B.3.1.1 Samples for FBE and liquid coatings**
Cold cut 100 mm × 100 mm × 6 mm plates and apply the FJC material under conditions of application similar to those for a field joint coating .

**B.3.1.2 Samples for heat shrinkable materials, flame spray coatings , injection molded coatings , tapes and others**
Cold cut 150 mm long , 100 mm diameter pipe sections (coated or bare) and coat these samples with the FJC under conditions of application similar to those for a field joint coating .

#### B.3.2 Samples from qualification trials

**B.3.2.1 Samples for FBE and liquid coatings**
Cold cut 100 mm× 100 mm × WT samples with direct to metal joint coating and joint coating onto plant coating .

**B.3.2.2 Samples for heat shrinkable materials , flame spray coatings , injection molded coatings , tapes and others**

Cold cut 150 mm pipe rings with direct to metal joint coating and joint coating on plant coating . If the pipe diameter is too large , 100 mm × 100 mm × WT panels may be used with some coating systems .

**B.4 Preparation of test area**

To ensure freedom from holidays , test the prepared panels or rings for holidays with the holiday detector set at the required voltage for the coating system .

**B.5 Test procedure**

The following steps shall be followed .

- 5 samples per coating shall be used for evaluation ;
- Carry out an initial adhesion test on one sample as described in clause 1.6 ;
- Attach plastic cylinders onto four samples using the elastomeric adhesive, lightly abrade or flame oxidize coating surface if required to form a water–resistant seal .
- Allow sealant to set or cure fully. On samples cut from pipes, the bottom of plastic cylinder may have to be cut to conform to the curvature of the panel ;
- Fill the cylinder with 400 ml ± 50 ml of tap water preheated to test temperature and seal the top opening with a plastic film. Place sample into oven set at test temperature ;
- Remove one sample after seven days ;
- Allow to cool to ambient temperature and test adhesion as specified in clause 10 to 17 . Repeat the adhesion test at intervals of seven days up to 28 days .

**B.6 Results**

For coating 1B and 1C record whether it leaves a film of compound during the peel test on the steel substrate and on the parent coating .

For other coatings, report the peel strength in N/mm or the degree of disbondment from the steel substrate and the parent coating .