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National Iranian Gas Co.

مدیریت پژوهش و فناوری

Research and Technology Management

امور تدوین استانداردها

Standardization Division

IGS

Iranian Gas Standards

Specification for :

مشخصات فنی :

Inhibitive Package for Boilers

پکیج بازدارنده دیگهای بخار

APPROVED

## **FOREWORD**

This standard is intended to be mainly used by **NIGC** and 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 ammended by technical standard committees within NIGC Standardization Div. 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 div.

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 . Therefore , all queries for clarification or amendments are requested to be directed to the mentioned div.

2- "**COMPANY** " : refers to national iranian gas company .

3- "**SUPLIER**" : 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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## پیشگفتار

- ۱- این استاندارد/دستورالعمل بمنظور استفاده اختصاصی در شرکت ملی گاز ایران و شرکتهای فرعی وابسته تهیه شده است.
- ۲- شرکت ملی گاز ایران در مورد نیازهای عمومی از استانداردهای وزارت نفت (IPS) و در مورد نیازهای اختصاصی از استانداردهای اختصاصی خود (IGS) استفاده می نماید.
- ۳- استانداردهای شرکت ملی گاز ایران (IGS) توسط کمیته های تخصصی استاندارد متشکل از کارشناسان بخش های مختلف و یا مشاور تهیه می شود و توسط شورای استاندارد (منتخب هیئت مدیره شرکت ملی گاز ایران) به تصویب میرسند.
- ۴- در تنظیم متن استانداردهای (IGS) از کلیه منابع شناخته شده استاندارد، اطلاعات فنی - تخصصی مربوط به صنایع گاز دنیا، مشخصات فنی تولیدات سازندگان معتبر جهانی و نیز از نتیجه تحقیقات و تجربیات کارشناسان و متخصصان داخلی بر حسب مورد استفاده می شود. همچنین بمنظور استفاده هر چه بیشتر از تولیدات داخلی قابلیت های سازندگان داخلی نیز مورد توجه قرار میگیرد.
- ۵- استانداردها از طریق پایگاه اینترنتی شرکت\* و یالوح فشرده (CD) در اختیار واحدها و کاربران قرار می گیرد .
- ۶- استانداردها بطور متوسط هر ۵ سال یکبار و یادر صورت ضرورت زودتر، مورد بازنگری و بروزرسانی قرار میگیرند. بنابراین کاربران باید همیشه آخرین نگارش را مورد استفاده قرار دهند.
- ۷- هرگونه نظر و یا پیشنهاد اصلاح در مورد استانداردها مورد استقبال و بررسی قرار خواهد گرفت و در صورت تأیید، استاندارد مربوطه نیز مورد تجدیدنظر قرار خواهد گرفت .

## تعاریف عمومی

در متن استانداردهای (IGS) از تعاریف و اصطلاحات زیر استفاده میشود.

- ۱- "شرکت" (COMPANY): منظور از شرکت "شرکت ملی گاز ایران" و یا شرکتهای فرعی وابسته میباشد.
- ۲- "فروشنده" (SUPPLIER/VENDOR): به فرد یا موسسه ای اطلاق میگردد که تعهدی رانسبت به شرکت تقبل نموده است.
- ۳- "خریدار" (PURCHASER): منظور از خریدار "شرکت ملی گاز ایران" و یا شرکتهای فرعی وابسته میباشد.
- ۴- "SHALL": در مواردی بکاربرده میشود که انجام خواسته مورد نظر اجباری است
- ۵- "SHOULD": در مواردی بکاربرده میشود که انجام خواسته مورد نظر ترجیحی و درعین حال اختیاری است
- ۶- "MAY": در مواردی بکاربرده میشود که انجام کار به شکل مورد بحث نیز قابل قبول میباشد

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شرکت ملی گاز ایران

**National Iranian Gas Co.**

**امور پژوهش و استانداردهای صنعتی**

# IGS

**Iranian Gas Standards**

Specification for :

**INHIBITIVE PACKAGE FOR BOILERS**

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**1. SCOPE**

THIS STANDARD SPECIFICATION GIVES THE PROCEDURE FOR PURCHASING AN INHIBITIVE PACKAGE WHICH WILL BE USED IN BOILERS TO INHIBIT ALL TYPES OF CORROSION , SCALE FORMATION AND SLUDGE ( SEE 3.4 ) IN NATURAL GAS TREATING PLANTS .

**2. REFERENCES**

THROUGHOUT THIS STANDARD SPECIFICATION THE FOLLOWING STANDARDS AND CODES ARE REFERRED TO . THE EDITIONS OF THESE STANDARDS AND CODES THAT ARE IN EFFECTED AT THE TIME OF ISSUES PUBLICATION OF THIS STANDARD SPECIFICATION ( 1999 ) 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 THIS STANDARD SPECIFICATION SHALL BE MUTUALLY AGREED UPON BY THE PARCHASER AND SUPPLIER AND /OR MANUFACTURER .

ASTM ( AMERICAN SOCIETY FOR TESTING AND MATERIALS )  
G46-76 ( REAPPROVED 1986 ) " EXAMINATION AND  
EVALUATION OF PITTING CORROSION "

IPS ( IRANIAN PETROLEUM STANDARDS )  
1-TP-802 ( 0 ) " CORROSION SURVEY AND INHIBITOR  
EVALUATION " ( 1998 )

NACE ( NATIONAL ASSOCIATION OF CORROSION ENGINEERS )  
TM-01-71 " AUTOCLAVE CORROSION TESTING OF  
METALS IN HIGH TEMPERATURE WATER "

US MILITARY STANDARDS  
MIL - STD - 105 " SAMPLING PROCEDURES AND TABLES  
FOR INSPECTION BY ATTRIBUTES "

**3. SYSTEM DESIGN**

THE SUPPLIER AND/OR MANUFACTURER SHALL DESIGN AN INHIBITIVE PACKAGE TO BE ABLE TO INHIBIT ALL TYPES OF CORROSION AND SCALE FORMATION AND SLUDGE ( SEE 3.4 ) IN THE BOILERS MEETING THE ATTACHED DATA SHEET COMPLETED BY THE END USER ( SEE APPENDIX A ) AND PROPOSE IT TO THE PURCHASER . THE SUPPLIER AND/OR MANUFACTURER SHALL GIVE FULL DETAILS OF THE PROPOSED PACKAGE AND SPECIFY THE FUNCTION ( S ) OF THE

PACKAGE INHIBITOR ( S ) . THE PROPOSED PACKAGE SHALL ALSO MEET THE FOLLOWING REQUIREMENTS .

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### **3.1 DEFINITIONS**

**APPROVED PRODUCTS :** THE APPROVED PRODUCTS ARE THOSE PRODUCTS WHOSE APPROVAL TEST SAMPLES ( SEE 4.1 ) HAVE BEEN LABORATORY TESTED AND HAVE PASSED THE APPROVAL TESTS SPECIFIED HEREIN ( SEE 4 ) AND HAVE BEEN LISTED ON OR APPROVED FOR BEING LISTED AS APPROVED SAMPLES .

**APPROVED SUPPLIERS :** THE SUPPLIERS AND / OR MANUFACTURER OF APPROVED PRODUCTS WILL BE KNOWN AS APPROVED SUPPLIERS .

**ACCEPTED PRODUCTS :** THE ACCEPTED PRODUCTS ARE THOSE PRODUCTS WHICH HAVE PASSED THE APPROVAL TESTS AS WELL AS ACCEPTANCE OPERATIONAL TEST ( SEE 3.6 ) .

**QUALIFIED PRODUCTS :** THE QUALIFIED PRODUCTS MEAN THE ACCEPTED PRODUCTS PROPOSED WITH RESPECT TO THIS STANDARD SPECIFICATION WHICH MEET ALL REQUIREMENTS OF THIS STANDARD SPECIFICATION .

**QUALIFIED SUPPLIER ( S ) :** THE SUPPLIER AND/OR MANUFACTURER OF QUALIFIED PRODUCTS WILL BE KNOWN AS THE QUALIFIED SUPPLIER ( S ) .

**FINAL SUPPLIER :** THE SUCCESSFUL BIDDER IS KNOWN AS THE FINAL SUPPLIER .

### **3.2 FORMULATION CHANGES**

THE PRESENTED MATERIAL ( S ) FOR SUPPLY SHALL BE ACCEPTED ONLY FOR THE FORMULATION FOR WHICH APPROVAL AND ACCEPTANCE OPERATIONAL TESTS ARE MADE . ANY CHANGE ( S ) IN FORMULATION , SHALL CAUSE FOR DESIGNATING THE MATERIAL AS A NEW MATERIAL WHICH SHALL NOT BE CONSIDERED ACCEPTED . THE MANUFACTURER MAY SUBMIT THE MODIFIED MATERIAL FOR ACCEPTANCE UNDER THIS STANDARD SPECIFICATION , USING A NEW MANUFACTURER'S DESIGNATION .

### **3.3 APPLICABILITY**

INHIBITOR(S) SHALL BE EASILY APPLICABLE WHEN USED FOR LOADING INTO THE BOILER WITHOUT ANY VIGOROUS OR IMPRACTICAL EFFORT .

### 3.4 QUALIFICATION

#### 3.4.1 GENERAL CORROSION

THE PROPOSED INHIBITIVE PACKAGE SHALL MAINTAIN THE

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GENERAL CORROSION RATE , IN THE BOILER AND RETURN LINES , LESS THAN 0.127 mmpy ( 5.0 mpy ) WHEN MONITORED BY WEIGHT LOSS COUPONS TECHNIQUE SPECIFIED IN SECTION 6 AND TABLE 2/1 OF THE IRANIAN PETROLEUM STANDARDS IPS-I-TP-802 ( 0 ) ( APPENDIX B ) .

#### 3.4.2 PITTING

THE PITTING OR ACCELERATED PINPOINT CORROSION OF BOILER TUBES AND RETURN LINES SHALL NOT BE TOLERATED . THE INHIBITIVE PACKAGE SHALL PREVENT THE PITTING TO OCCUR . THE PITTING RATING SHALL BE A-1 , B-1 , C-1 OF CLAUSE 7.2 OF ASTM G46 WHEN MONITORED BY WEIGHT LOSS COUPONS TECHNIQUE SPECIFIED IN SECTION 6 AND TABLE 2/1 OF THE IRANIAN PETROLUM STANDARDS IPS-I-TP-802 ( 0 ) ( APPENDIX B ) .

#### 3.4.3 SCALE FORMATION

THE FORMATION OF SCALE IN THE BOILER , TUBES OR SHELL , WHETHER DUE TO CARBONATE , IRON , PHOSPHATE , SILICA , OR ANY COMBINATION OF THE SAME , WILL NOT BE TOLERATED . ON INSPECTION 90 DAYS AFTER USING THE PROPOSED INHIBITIVE PACKAGE THE BOILER(S) SHALL INPRACTICE BE FREE OF SCALE OR ANY ENCRUSTING MATTER .

#### 3.4.4 SLUDGE

THIS PROBLEM SHALL BE PREVENTED VIA THE USE OF INHIBITIVE PACKAGE . THERE SHALL BE NO APPARENT SLUDGE , ON INSPECTION , AFTER 90 DAYS OF USING THE PROPOSED INHIBITIVE PACKAGE .

### 3.5 ECONOMICAL ASPECTS

THE PROPOSED INHIBITIVE PACKAGE SHALL MEET THE REQUIREMENTS OF CLAUSE 3.1 AT THE LOWEST COST PER YEAR ( SEE DATA SHEET ) . THE COST EVALUATION WILL BE MADE BY THE PURCHASER ( TECHNICAL DEPARTMENT OF



END USER IN THIS CASE ) , WITH REFERENCE TO THE PERFORMANCE OF THE PRODUCT ( S ) ( SEE 3.1 ) , INCLUDING COST OF PRODUCT ( S ) PER YEAR AND OTHER COSTS SUCH AS FORWARDING SHIPMENT , STORAGE , OPERATION AND SO ON .

### **3.6 ACCEPTANCE OPERATIONAL TEST**

A 90-DAY CONTINUOUS OPERATIONAL TEST WILL BE PERFORMED ON APPROVED PRODUCTS ( SEE 7 ) . THE PRODUCTS SHALL MEET THE SUBCLAUSE 3.4 OF THIS STANDARD SPECIFICATION ( QUALIFICATION ) .

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### **3.7 TECHNICAL SERVICES**

THE APPROVED SUPPLIER SHALL FURNISH FREE OF CHARGE ALL TECHNICAL SERVICES INCLUDING PERSONNEL , DOCUMENTATION , FINAL REPORTS AND TESTS INSTRUMENTATION IN ACCORDANCE WITH THE REQUIREMENTS OF THE ACCEPTANCE OPERATIONAL TEST . THE FINAL SUPPLIER SHALL SUPPLY FREE OF CHARGE AND IN TIME ALL NECESSARY TECHNICAL SERVICES DURING OPERATION .

## **4. APPROVAL TESTS**

APPROVAL TESTS ARE THE LABORATORY TESTS PERFORMED ON THE SAMPLES SUBMITTED FOR APPROVAL . THE APPROVAL TESTS OF THE INHIBITOR ( S ) WILL CONSIST OF THE TESTS OF THIS STANDARD SPECIFICATION ( SEE 11 ) .

### **4.1 APPROVAL TEST SAMPLES**

4.1.1 APPROVAL TEST SAMPLE ( S ) SHALL CONSIST OF SUFFICIENT AMOUNT OF ALL MATERIAL ( S ) PROPOSED AS AN INHIBITIVE PACKAGE FURNISHED UNDER THIS STANDARD SPECIFICATION . SAMPLE ( S ) SHALL BE FORWARDED TO THE PURCHASER . SAMPLE ( S ) SHALL BE PLAINLY IDENTIFIED BY SECURELY ATTACHED DURABLE TAGS OR LABELS MARKED WITH FOLLOWING INFORMATION :

SAMPLE FOR QUALIFICATION TESTS ( OR APPROVAL TESTS )

BRAND NAME

NAME OF PRODUCTION PLANT ( PLANT WHERE INHIBITOR IS MASS PRODUCED )

MATERIAL DESIGNATION ( PRODUCT REF/CODE )

DATE OF PRODUCTION

**4.1.2 THE SUPPLIER AND/OR MANUFACTURER SHALL ALSO PROVIDE**

**THE OPERATIONAL INFORMATION WITH EACH SAMPLE AS FOLLOWS :**

- DESCRIPTION AND FUNCTION (S)
- ANALYTICAL CONTROL
- OPERATIONAL INSTRUCTION
- DOSAGE IN " LIT/DAY " WITH REFERENCE TO THIS - - STANDARD SPECIFICATION ( SEE DATA SHEET )
- HANDLING
- STORAGING
- SHELIFE
- OTHERS

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**4.1.3 THE SUPPLIER SHALL SPECIFY PHYSICAL PROPERTIES FOR THE**

**MATERIAL (S) COVERING THE FOLLOWINGS :**

- FORM
- PH
- COLOR
- ODOR
- POUR POINT
- FLASH POINT
- VISCOSITY AT 20° C
- SPECIFIC GRAVITY
- DENSITY AT 20° C
- SOLUBILITY IN WATER AT 20° C
- OTHERS

**4. PRODUCTION TESTS**

**PRODUCTION TESTS ARE THE ONES NORMALLY PERFORMED BY THE PRODUCER ON SAMPLES TAKEN FROM PRODUCTION RUN DURING THE PRODUCTION OF INHIBITOR (S) ACCORDING TO ITS OWN QUALITY STANDARD . THE MANUFACTURER SHALL PROVIDE THE PRODUCTION TESTS REPORTS TO THE MENTIOND STANDARD .**

**5. QUALITY ASSURANCE**

**THE SUPPLIER SHALL PROVIDE A QUALITY ASSURANCE CERTIFICATE TO ENSURE THAT THE INHIBITOR (S) PROPOSED COMPLIES WITH THIS STANDARD SPECIFICATION .**

## **6. ACCEPTANCE OPERATIONAL SAMPLES**

THE APPROVED SUPPLIER WHOSE PROPOSED PRODUCTS MEET SUBCLAUSE 3.5 WILL BE REQUESTED TO SUPPLY SUFFICIENT AMOUNT OF APPROVED PRODUCT ( S ) FOR A CONTINUOUS 90 DAY ACCEPTANCE OPERATIONAL TEST .

## **7. STORAGE LIFE AND PACKAGING**

### **8.1 STORAGE LIFE**

THE INHIBITOR ( S ) SHALL MEET ALL REQUIREMENTS OF THIS STANDARD SPECIFICATION AT LEAST 24 MONTHS FROM DATE OF DELIVERY .

### **8.2 PACKAGING**

THE MATERIAL ( S ) SHALL BE SUITABLY PACKAGED IN APPROVED CONTAINERS AND PROTECTED AGAINST ALL DAMAGES OR DEFECTS WHICH MAY OCCUR DURING HANDLING AND SEAWORTHY SHIPMENT .

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### **8.3 COMPATIBILITY OF THE CONTAINER WITH INHIBITIVE MATERIAL**

THE CONTAINER MATERIAL SHALL BE COMPATIBLE WITH INHIBITOR ( S ) TO THE EXTENT THAT IT SHALL NOT CAUSE DELAMINATION , SWELLING , EMBRITTLEMENT , DISSOLUTION , OR OTHER DETERIORATION SUCH AS TO CAUSING THE DEGRADATION OF THE CONTAINER MATERIAL .

## **9 INSPECTION AND QUALITY ASSURANCE ( QA )**

9.1 THE MANUFACTURER AND/OR SUPPLIER SHALL BE RESPONSIBLE FOR CARRYING OUT ALL THE TESTS AND QA'S REQUIRED BY THIS STANDARD SPECIFICATION ( SEE 3.4 ) , USING HIS OWN OR OTHER RELIABLE FACILITIES , AND HE SHALL MAINTAIN COMPLETE RECORDS OF ALL SUCH TESTS AND QUALIFICATIONS . SUCH RECORDS SHALL BE AVAILABLE FOR REVIEW BY THE PURCHASER . THE MANUFACTURER AND/ OR SUPPLIER SHALL FURNISH TO THE PURCHASER A CERTIFICATE OF QUALITY STATING THAT EACH LOT HAS BEEN SAMPLED , TESTED , AND QUALIFIED IN ACCORDANCE WITH THIS STANDARD SPECIFICATION AND HAS BEEN FOUND TO MEET THE REQUIREMENTS SPECIFIED .

9.2 AN INSPECTION LOT SHALL CONSIST OF A BATCH ( OR BATCHES ) OF PRODUCTION PROCESSED FROM THE SAME

MATERIAL COMPONENTS , AND OFFERED FOR INSPECTION AT ONE TIME .

- 9.3 THE MANUFACTURER AND/OR SUPPLIER SHALL AFFORD THE PURCHASER'S INSPECTOR ALL REASONABLE FACILITIES REQUIRED FOR INSPECTION OF EACH BATCH OF PRODUCTION IN ACCORDANCE WITH THIS STANDARD SPECIFICATION . SUCH INSPECTION IN NO WAY RELIEVES THE MANUFACTURER AND / OR SUPPLIER OF HIS RESPONSIBILITIES UNDER THE TERM OF THIS STANDARD SPECIFICATION .
- 9.4 THE PURCHASER RESERVES THE RIGHT TO PERFORM ANY INSPECTIONS SET FORTH IN THIS STANDARD SPECIFICATION WHERE SUCH INSPECTIONS ARE DEEMED NECESSARY TO ASSURE THAT SUPPLIES AND SERVICES CONFORM TO THE PRESCRIBED REQUIREMENTS .
- 9.5 THE PURCHASER'S INSPECTOR RESERVE THE RIGHT TO HAVE ACCESS TO THE MATERIALS SUBJECT TO INSPECTION FOR THE PURPOSE OF WITNESSING SELECTION OF THE SAMPLES , PREPARATION OF THE TEST SAMPLES AND PERFORMANCE OF THE TEST ( S ) . FOR SUCH

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TESTS , THE INSPECTOR RESERVES THE RIGHT TO INDICATE THE SAMPLE ( S ) FROM WHICH THE QUANTITIES WILL BE TAKEN IN ACCORDANCE WITH THE PROVISIONS OF THIS STANDARD SPECIFICATION .

- 9.6 SAMPLING FOR VISUAL INSPECTION  
THE RANDOM SAMPLE ( S ) OF FILLED CONTAINERS SHALL BE SELECTED FROM EACH INSPECTION LOT BY PURCHASER'S INSPECTOR IN ACCORDANCE WITH STANDARD MIL – STD-105 AT INSPECTION LEVEL I AND ( AQL ) 2.5 PERCENT DEFECTIVE TO VERIFY CONFORMANCE TO ALL REQUIREMENTS OF THIS STANDARD SPECIFICATION REGARDING FILL , CLOSURE AND MARKING .

## **10 MARKING**

### **10.1 MARKING OF CONTAINERS**

EACH CONTAINER SHALL BE LEGIBLY MARKED AT LEAST WITH FOLLOWING INFORMATION :

MANUFACTURER'S NAME AND ADDRESS  
PURCHASER'S NAME AND ADDRESS  
STANDARDS SPECIFICATION : ( IGS-MS-CH-035-1999 )  
MESC NO.  
HANDLING GUIDELINES  
STORAGING SYMBOLS  
DATE OF MANUFACTURE  
BATCH NO.

**10.2 INSTRUCTION**

SUPPLIER SHALL PROVIDE COMPLETE SETS OF INSTRUCTIONS FOR USE COVERING DOSAGE , LOCATION OF FEEDING , TYPE OF INJECTION SYSTEM AND ANALYTICAL CONTROL THOROUGHLY .

**10.3 PRECAUTIONARY MARKING**

ALL INDIVIDUAL CONTAINERS SHALL BE MARKED WITH PRECAUTIONARY SYMBOLS OR PHRASES .

**11 . LABORATORY TEST**

THE TESTING OF INHIBITIVE PACKAGE SHALL BE PERFORMED ON TEST SAMPLES ( SEE 4.1 ) TO THE METHODS OF NACE STANDARD TM – 01 – 71 AND EVALUATED AS FOLLOWS :

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**11.1 GENERAL CORROSION**

THE GENERAL CORROSION RATE OF THE PROPOSED INHIBITIVE PACKAGE SHALL BE LESS THAN 0.127 mmpy ( 5.0 mpy ) .

**11.2 PITTING**

THE SAMPLE SHALL BE EXAMINED FOR PITTING OR ACCELERATED PINPOINT CORROSION TO ASTM G46. THE RATING SHALL BE A-1 , B-1 , C-1 OF CLAUSE 7.2 OF ASTM G46 .

**11.3 SCALE FORMATION**

THERE SHALL BE NO SCALE FORMATION IN THE SYSTEM EITHER ON WATER – SIDE OR ON THE SURFACE .

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**APPENDIX " A "**  
**( DATA SHEET )**



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## 1. DESIGN DATA ( INFORMATIVE AND FOR GUIDANCE )

TYPE AND NUMBER OF BOILERS	STEAM PRESS URE AT SUPER HEATE	S T E A M	FOR BOILER NOT EQUIPPED WITH SUPERHEATER STATE	M A X I M U M	P E A K  L O	F E E D  W A	F E E D  W A
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<p>N A T U R A L C I R C U L A T I O N</p>	<p>O T H E R S ( S P E C I F Y )</p>	<p>R O U T E</p>	<p>T E M P E R A T U R E A T S U P E R H E A T E R O U T L E T</p>	<p>S A T U R A T E D S T E A M T E M P E R A T U R E</p>	<p>S A T U R A T E D S T E A M P R E A S U R E</p>	<p>C O N T I N U O U S C A P A C I T Y</p>	<p>A D ( F O R 4 H O U R S % M A X I M U M C O N T I N U O U S</p>	<p>T E M P E R A T U R E A T B O I L E R I N L E T</p>	<p>T E M P E R A T U R E P R E S S U R E</p>
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## 2. BOILER FEED WATER

TYPE AND NUMBER OF BOILER	BOILER FEED WATER TREATMENT	BOILER FEED WATER RATE	BOILER BLOW DOWN RATE
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N A T U R A L  C I R C U L A T I O N	OT HE RS ( SPE CIF Y )	HOT LINE/S ODA ASH/ Mgo/ZE OLITE SOFTE NER	OTHE RS ( SPEC IFY )	C O N D E N S A T E R E T U R N  R A T E	T R E A T E D W A T E R E X S O F T E N E R	( BLOW DOWN RATE AS PERCENT OF BOILER FEED WATER RATE )

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### 3. DEAERATION DATA

TYPE AND NUMBER OF BOILER	TYPE	S U P	DEAERATE D WATER OUTLET	O <sub>2</sub> CONTE NT OF	CO <sub>2</sub> CONT ENT	O P E
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N A T U R A L C I R C U L A T I O N	O T H E R S ( S P E C I F Y )	J E T - T R A Y	O T H E R ( S P E C I F Y )	P L Y  R A T E	TEMPERAT URE	DEAER ATED WATER EFFLU ENT	OF DEAE RATE D WATE R EFFL UENT	R A T I N G S T E A M  P R E S S U R E

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**4.DESIGN DATA OF FEED WATER ( FOR GUIDANCE AND INFORMATION )**

TYPE AND NUMBER OF BOILER	T O T A L	M - A L	P - A L	O H A	T U R B	P H (	S I O 2	O 2	O H	C O N D
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<p>N A T U R A L C I R C U L A T I O N</p>	<p>O T H E R S ( S P E C I F I F Y )</p>	<p>L H A R D N E S E</p>	<p>K A L I N I T Y</p>	<p>K A L I N I T Y</p>	<p>L K A L I N I T Y</p>	<p>I D I T Y</p>	<p>2 5 ° C )</p>				<p>U C T I V I T Y ( 2 5 ° C )</p>

--	--	--	--	--	--	--	--	--	--	--	--

### 5. OPERATING CONDITION

COMPLETE FOR EACH BOILER SEPARATELY IF EXISTED DIFFERENT TYPES OF BOILER IN THE UNIT .

TYPE OF BOILER :  
OF BOILER :

NUMBER

T E S T	S O F T W A T E R	T R E A T E D W A T E R	F E E D W A T E R	B O I L E R W A T E R	C O L D C O N D E N S A T E	H O T C O N D E N S A T E
P H						
T O T						

A L H A R D N E S S						
P- A L K A L I N I T Y						
M- A L K A L I N I T Y						
O H- A						

L K A LI NI T Y						
Na C L						
P O4 AS P O4						
T O T A L IR O N						
Si O2						
O2						
SO 3						
N U						

<b>M BE R O F C O N C E N T R A T I O N</b>						
<b>T DS AS Ca C O3</b>						

**6. PRESENT TREATMENT ( FOR GUIDANCE AND INFORMATION )**

COMPLETE FOR EACH BOILER SEPARATELY IF EXISTED DIFFERENT TREATMENT .

TYPE OF BOILER :  
BOILER :

NUMBER OF

CHEMICAL		CONDENSATE SYSTEM			
COMPOU	RESIDUA PPM IN BOILER WA	FILMING INHIBITOR		NEUTRALIZING INHIBITO	
		COMPC	RESIDUAL ppm IN CONDENSE RETURN	COMPC	RESIDUAL p IN CONDENS RETURN



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## APPENDIX " B "

**IPS  
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**6.1.1.1 A COMPREHENSIVE REVIEW OF THE PROCESS PLANT MATERIALS , CORROSION ALLOWANCES AND OPERATING CONDITIONS SHOULD BE CARRIED OUT TO IDENTIFY ALL AREAS WHICH COULD BE SUSCEPTIBLE TO SIGNIFICANT CORROSION WITHIN THE PROJECTED LIFESPAN OF THE PLANT .AN ASSESSMENT OF THE CONSEQUENCES OF A CORROSION FAILURE OCCURRING WILL BE AN INTEGRAL PART OF THE REVIEW . THE IDENTIFICATION OF THE SPECIFIC CORROSION PROCESSES LIKELY TO OCCUR IS ESSENTIAL TO THE SELECTION OF PARTICULAR ON-LINE CORROSION MONITORING DEVICES TO BE USED .THE REVIEW SHOULD ALSO IDENTIFY THOSE PARAMETERS WHICH ARE INSTRUMENTAL IN CAUSING CORROSION AND WHICH ARE LIKELY TO INFLUENCE THE CORROSION RATE ,THE RESULTS OF THE REVIEW SHOULD BE USED TO DEVELOP A CORROSION MONITORING STRATEGY ENCOMPASSING THE FOLLOWING :**

- IDENTIFICATION AND LOCATION OF MONITORING DEVICES AND THEIR LOCATION :
  - PRESCRIBED MONITORING FREQUENCIES .
  - AGREED MONITORING PROCEDURES .
  - THE ALLOCATION OF RESPONSIBILITIES FOR .
- A) ENSURING THAT MONITORING IS CARRIED OUT IN ACCORDANCE WITH THE DEFINED PROCEDURES ,
- B) THE INTERROGATION , STORAGE AND RETRIEVAL OF THE INFORMATION RECORDED ,
- C) THE PRESENTATION OF DETAILED REPORTS AT THE REQUIRED FREQUENCY
- .

**6.1.1.2 FOR NEW PROJECTS THE CORROSION MONITORING REQUIREMENTS SHALL BE ESTABLISHED DURING THE EARLY DEVELOPMENT OF THE DESIGN .**

**6.2 EQUIPMENT**

**THE SELECTION OF THE SPECIFIC ON-LINE CORROSION MONITORING DEVICES WILL BE DETERMINED BY THE KNOWN OR PERCEIVED CORROSION PROCESSES TAKING PLACE . INDIVIDUAL CORROSION MONITORING DEVICES PROVIDE ONLY A LIMITED AMOUNT OF INFORMATION .A MINIMUM OF TWO TECHNIQUES SHOULD BE USED TO MONITOR CORROSION IN ORDER TO PROVIDE COMPLEMENTARY DATA . IN ADDITION THE INFORMATION PROVIDED BY THE CORROSION MONITORING**

**DEVICES SHOULD BE SUPPLEMENTED BY DETAILED OPERATIONAL DATA COVERING THE MONITORING PERIOD ,CHEMICAL ANALYSIS OF PROCESS FLUIDS AND EQUIPMENT INSPECTION RECORDS .**

**ON-LINE INTERNAL CORROSION MONITORING SHOULD BE UNDERTAKEN USING PROPRIETARY ACCESS FITTINGS WHICH PERMIT THE INSTALLATION AND REMOVAL OF PROBES AND COUPONS WITHOUT THE NEED FOR PLANT SHUTDOWN .THE DESIGN AND MECHANICAL PROPERTIES OF SUCH FITTINGS MUST MEET THE REQUIREMENTS OF THE APPROPRIATE STANDARD(S) AND CODE (S) USED FOR THE DESIGN AND CONSTRUCTION OF THE PLANT BEING MONITORED .**

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TABEL 2/1 – CHARACTERISTICS OF CORROSION MONITORING TECHNIQUES

TECHNIQUE	TIME FOR INDIVIDUAL MEASUREMENT	TYPE OF INFORMATION	SPEED OF RESPONSE TO CHANGE	RELATIONSHIP TO PLANT	POSSIBLE INTERFERENCE	TYPE OF CORROSION	EASE OF INTERPRETATION	TECHNOLOGICAL CULTURE NEEDED
ELECTRIC RESISTANCE	INSTANTANEOUS	INTEGRATED CORROSION RATE	MODERATE	PROB	ANY	GENERAL	NORMALLY EASY	RELATIVELY SIMPLE
POLARIZATION RESISTANCE	INSTANTANEOUS	RATE	FAST	PROB	ELECTROLYTE	GENERAL	NORMALLY EASY	RELATIVELY SIMPLE
POTENTIAL MEASUREMENT	INSTANTANEOUS	CORROSION STATE AND INDIRECT INDICATION OF RATE	FAST	PROB PLAN GENERAL	ELECTROLYTE	GENERAL OR LOCALIZED	NORMALLY RELATIVELY EASY BUT NEEDS KNOWLEDGE OF CORROSION MAY NEED EXPERIENCE	RELATIVELY SIMPLE
GALVANIC MEASUREMENTS (ZERO RESISTANCE AMMETER)	INSTANTANEOUS	CORROSION STATE AND INDICATION OF GALVANIC CURRENT	FAST	PROB OCCASIONALLY PLAN GENERAL	ELECTROLYTE	GENERAL OR UNFAVORABLE CONDITIONS LOCALIZED	NORMALLY RELATIVELY EASY BUT NEEDS KNOWLEDGE OF CORROSION	RELATIVELY SIMPLE
ANALYTICAL METHODS	NORMAL FAIRLY FLEXIBLE	CORROSION STATE, TOTAL CORROSION IN SYSTEM ITEM CORROSION RATE	NORMAL FAIRLY FAST	PLAN GENERAL	ANY	GENERAL	RELATIVELY EASY BUT NEEDS KNOWLEDGE OF PLANT	MODERATE TO DEMANDING
ACOUSTIC EMISSION	INSTANTANEOUS	CRACK PROPAGATION AND LEAK DETECTION	FAST	PLAN GENERAL	ANY CAVITATION	CRACKING CAVITATION AND LEAK DETECTION PITS	NORMALLY	CRACK PROPAGATION SPECIALIZED, OTHERWISE RELATIVELY SIMPLE
THERMOGRAPHY	RELATIVELY FAST	DISTRIBUTION OF ATTACK	POOR	LOCALIZED ON PLANT	ANY MIST BE WIND OR SURFACE AMBIENT	LOCALIZED	EASY	SPECIALIZED AND DIFFICULT
OPTICAL (CLOSED CIRCUIT TYPICALLY LIGHT TUBE ETC)	FAST WITH ACCESS AVAILABLE OTHERWISE SLOW	DISTRIBUTION OF ATTACK	POOR	LOCALIZED ON PLANT	ANY	LOCALIZED	EASY	RELATIVELY SIMPLE
VISUAL WITH AID OF GAUGE	SLOW, REQUIRE ENTRY ON SHUTDOWN	DISTRIBUTION OF ATTACK INDICATION OF RATE	POOR	ACCESSIBLE SURFACE	ANY	GENERAL OR LOCALIZED	EASY	RELATIVELY SIMPLE BUT EXPERIENCE NEEDED

CORROSION COUPONS	LONG DURATION EXPOSURE	AVERAGE CORROSION RATE AND FORM	POOR	PROB	ANY	GENERAL OR LOCALIZED	EASY	SIMPLE
ULTRASON	FAIRLY	REMAINING THICKNESS PRESENCE OF CRACKS AND PITS	FAIRLY POOR	LOCALIZED ON PLAN	ANY	GENERAL OR LOCALIZED	EASY	SIMPLE
HYDROGEN PROBE	FAST OR INSTANTANEOUS	TOTAL CORROSION	FAIRLY POOR	LOCALIZED ON PLAN	NONOXIDIZING ELECTROLYTE OR GASES	GENERAL	EASY	SIMPLE
SENTINEL HOLES	SLOW	GO/NOGO REMAINING THICKNESS	POOR	LOCALIZED ON PLAN	ANY GAS OR VAPOUR PREFERRED	GENERAL	EASY	RELATIVELY SIMPLE
RADIOGRAPHY	RELATIVELY SLOW	DISTRIBUTION OF CORROSION	POOR	LOCALIZED ON PLAN	ANY	PITTING POSSIBLE CRACKING	EASY	SIMPLE BUT SPECIALIZED RADIATION HAZARD

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### 6.3 Safety

statutory and safety considerations relevant to the specific hazardous areas as cited in ips-e-el-110 , where corrosion monitoring activities are being carried out , must be followed .

### 6.4 techniques ( see table 3/1 )

#### 6.4.1 weight loss coupons

coupons may be used to determine the average fluid corrosivity by measurement of weight loss . susceptibility to pitting , bimetallic corrosion , stress corrosion cracking , crevice corrosion , corrosion in weldments or heat affected zones ( haz ) , hydrogen embrittlement , scaling , erosion and cavitation may also be determined . the method facilitates an assessment of the corrosivity of an environment with respect to the specific material of construction of that part of the plant in which the corrosion monitoring is taking place .

the chemical composition and metallurgical condition of the coupon material should be as close as possible to that of the plant material . the results may be influenced significantly by the monitoring location within the plant and the position of the coupon(s) in the process stream , see nace pro775 .

careful consideration shall be given to the proposed monitoring location and coupon position during the development of the corrosion monitoring strategy .

the two most common types of weight loss coupon are strip and flush disc , although rods and rings may also be used in certain circumstances . guidance on coupon selection , handling exposure times and evaluation are given in nace pro775 .

each coupon shall carry its own individual identification mark and be degreased and uniformly grit blasted prior to exposure . where considered appropriate , as finished , metal surfaces may be evaluated but these are likely to give inconsistent results .

for purposes other than weight loss from a single metal or alloy , ( e.g. bimetallic corrosion , weldment corrosion , stress corrosion cracking ) novel coupon designs will be required , appropriate to the corrosion phenomena being evaluated .

coupons shall be attached to holders suitable for installation in low pressure or high pressure ( 50 mm ) access fitting systems as appropriate ( see figs. 1/1 and 2/1 ) .

exposed coupons should always be visually examined for the type and uniformity of the attack both before and after chemical cleaning . samples of corrosion product should be removed for detailed chemical analysis . where pitting is the predominant form of attack the extent and type of pitting may be evaluated in accordance with astm g46 – 76 .



TABLE 3/1 – GENERAL GUIDE TO THE APPLICATION OF CORROSION MONITORING TECHNIQUES

	WEIGHT LOSS COUPONS/SPOOL PIECES	CORROSION PRODUCT ANALYSIS	ELECTRICAL RESISTANCE PROBES	ELECTROCHEMIC AL (LPR) PROBES	GALVANIC PROBES	BACTERIAL MONITORING	SUSPENDED SOLIDS	DISSOLVED SOLIDS	DISSOLVED GASES	PH	POTENTIAL MEASUREMENT	HYDROGEN PROBES / PATCH
SEA WATER INJECTION AND COOLING SYSTEMS	√	√	√	√	√	√	√5	√	O <sub>2</sub> ONLY	√	x	x
PRODUCED WATER TREATMENT AND INJECTION SYSTEMS	√	√	√	x	x	√	√1	√	CO <sub>2</sub> , O <sub>2</sub> , H <sub>2</sub> S	√	x	x
AQUIFER WATER	√	√	√	1	x	√	√	√	CO <sub>2</sub> , H <sub>2</sub> S	√	x	x
UNSTABILISED CRUDE OIL	√	√	√	x	x	x	x	x	x	x	x	√6
HYDROCARBON GAS	√	√	√	x	x	x	x	x	x	x	x	√6
CRUDE DISTILLATION UNITS & ASSOCIATED PIPE WORK	√	√	√	x	x	x	x	x	x	√	x	√7
FLUIDISED CATALYTIC CRACKER UNK, FRACTIONATION AND LIGHT ENDS	√	√	√	x	x	x	x	x	x	x	x	√7
EFFLUENT WATER	√	√	√	x	2	√	x	√	O <sub>2</sub> , H <sub>2</sub> S	√	x	x
PROCESS UNITS REACTOR COLUMNS PIPEWORK	√	√	√	x	x	x	x	x	x	AQUEOUS SYSTEMS ONLY	√5	x
STORAGE VESSELS WITH SEPARATED WATER BOTTOM	√	√	√	x	x	√	x	x	H <sub>2</sub> S	√	x	x

1. DEPENDS ON WATER QUALITY. LPR UNSUITABLE WHERE THERE IS A STRONG SCALING TENDENCY OF OTHER FORM OF ELECTRODE CONTAMINATION IS POSSIBLE.
2. MAY BE USED WHERE OXYGEN CONTENT IS HIGH.
3. SEA WATER INJECTION SYSTEMS ONLY.
4. PRODUCED WATER INJECTION SYSTEMS ONLY.
5. WHERE PLANT MATERIALS DISPLAY A PRONOUNCED ACTIVE TO PASSIVE TRANSITION.
6. WHERE FLUIDS ARE OUR, IN ACCORDANCE WITH BP GROUP GS 136-1.
7. FOR SULPHUR CONTAINING FEEDSTOCKS.