IGS-EL-013(2) 1998

APPROVED مصوب

شرکت ملی گازایران

مدیریت پژوهش وفناوری

امورتدوین استانداردها

مشخصات فنی خرید

ترانسهای یکسو کننده سیستم حفاظت اززنگ

Transformer Rectifiers for Cathodic Protection

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IGS-EL-013(2) : 1998
Transformer Rectifiers

1. SCOPE

THIS SPECIFICATION OUTLINES THE MINIMUM QUALITY REQUIREMENTS OF THE HEAVY DUTY TRANSFORMER RECTIFIER UNIT FOR GAS PIPELINE CATHODIC PROTECTION THE POWER OF TR / REC AS SPECIFIED IN THE DATA SHEET (ITEM II)

2. SERVICE CONDITIONS :

THE TRANSFORMER - RECTIFIER UNIT SHALL BE SUITABLE FOR OUT DOOR INSTALLATION IN HUMID , SALT LADEN , DUSTY ATMOSPHERE AND DESIGNED FOR CONTINUOUS FULL LOAD OPERATION UNDER THE FOLLOWING SERVICE CONDITIONS .

A- MAXIMUM AMBIENT SHADE TEMPERATURE 50°C

MINIMUM AMBIENT SHADE TEMPERATURE -25°C

B- METAL SURFACES DIRECTLY EXPOSED TO SUN CAN AT TIMES REACH A SURFACE TEMPERATURE OF 85°C

C- ALTITUDE ABOVE SEA – LEVEL MAX . 2000M

D- MAXIMUM RELATIVE HUMIDITY 95%

E- LIGHTNING STORMS ARE AT TIMES SEVER BUT INFOREQUENT APPROXIMATLY ISOCERAUNIC LEVEL 60 STORM DAY / YEAR

F- ESTIMATED DUST CONCENTARATION OF 70 TO 1400 MILLIGRAM / CU METER . IT IS THE RESPONSIBILITY OF THE MANUFACTURER OR SUPPLIER TO ENSURE THAT TRANSFORMER - RECTIFIER AND ALL AUXILLARY APPARATUS AND EQUIPMENT ARE DESIGNED AND CONSTRUCTED TO OPERATE SATISFACTORILLY UNDER SPECIFIED SERVICE CONDITIONS .

3. APPLICABLE STANDARDS :

IN ADDITION TO THE REQUIREMENTS OF THE PARAGRAPHS CONTAINED HEREIN , THE TRANSFORMER – RECTIFIER UNIT AND ITS MAIN COMPONENTS SHALL CONFORM TO THE LATEST ISSUE OF FOLLOWING STANDARDS .

RECTIFICATION	------ , BS 2709
SEMI – CONDUCTOR RECTIFIER EQUIPMENT	IEC 146 , BS 4417
POWER TRANSFORMER	IEC 76 , BS 171
INSULATING OIL	IEC 296 , BS 148
FUSES	IEC 269 , BS 88
MOVING COIL METERS	IEC 51 , BS 89
SURGE DIVERTERS (ARRESTERS)	IEC 99 – 1A , BS 2914
SWITCHES AND SWITCH – FUSES	IEC 408 , BS 5419
CONTROL SWITCHES (CONTROL RELAYS)	IEC 337 -------
CONDUIT AND CABLE FITTINGS	BS 4568 & 6121 PART 1

THE FOLLOWING MECHANICAL FITTINGS FOR THE UNIT SHALL BE COMPLIED WITH RELEVANT STANDARDS :

A- OIL LEVEL GAUGE

B- THERMOMETER

C- OIL FILLER PLUG AND DRAIN VALVE

D- EARTH TERMINAL

E- SILICAGEL BREATHER

F- LIFTING LUGS

G- SUNSHADE (IF REQUIRED)

4. ELECTRICAL DATA :

4.1 AC INPUT VOLTAGE RATINGS :

AS SPECIFIED ON THE RELEVANT REQUISITION OR DATA SHEET , THE TR – RECT UNIT SHALL BE SUITABLE EITHER FOR 220 / 230 V , 50 HZ , SINGLE PHASE OR 380/400 V , 50 HZ , THREE PHASE AND NEUTRAL . FULL – RATED D.C. OUT – PUT SHALL BE OBTAINED WITH INPUT VOLTAGE 5% BELOW THE NOMINAL VALUE CONTINUOUS INPUT VOLTAGE 10% ABOVE NOMINAL VALUE SHALL NOT DAMAGE THE TRANSFORMER OR THE RECTIFYING ELEMENTS .

4.2 DC OUTPUT RATINGS :

THE DC OUT PUT SHALL BE AS SPECIFIED ON THE RELEVANT REQUISITION OR DATA SHEET . TR – REC . SHALL BE CAPABLE OF SUPPLYING CONTINUOUS FULL RATED OUTPUT VOLTAGE AND AMPER AT AN AMBIENT TEMPERATURE OF 50°C IN SHADE AT SUMMER TIME AND -25°C IN WINTER .

4.3 VOLTAGE ADJUSTMENT :

SUBJECT TO THE REQUIREMENT SPECIFIED ON THE RELEVANT REQUISITION AND/OR DATA SHEET , THE OUT PUT VOLTAGE SHALL BE REGULATED BY ONE OR COMBINATION OF TWO OF THE FOLLOWING METHODS .

A- THE OUTPUT SHALL BE REGULATED BY 3 TAPPINY SWITCHES :
COARS ,MEDIUM AND FINE , PROVIDING CONTROL IN 63 STEPS .

B- THE OUT PUT VOLTAGE SHALL BE ADJUSTABLE BY MEANS OF VARIABLE AUTO TRANSFORMER , LOCATED ON THE PRIMARY

SIDE OF STEP – DOWN TRANSFORMER , OFFERING A STEPLESS CONTINUOUS CONTROL FOR OUT PUT VOLTAGE .

VENDORS TO SUBMIT DETAILED SPECIFICATION FOR N.I.G.C ENGINEER APPROVAL .

5. ENCLOSURE :

TRANSFORMER RECTIFIER UNIT SHALL BE OUT DOOR TYPE , WEATHER PROOF (IP 54 , IEC 144) MADE OF ROBUST , HEAVY GAUGE SHEET STEEL TANK ARRANGED FOR PLINTH MOUNTING , UNLESS OTHERWISE SPECIFIED ON THE RELEVANT DATA SHEET .

FOR RESISTANCE TO OIL AND ATMOSPHERIC CORROSION THE ENCLOSURE SHALL BE FINISHED INSIDE AND OUTSIDE AS FOLLOWS ;

METAL SHEET SHALL BE FREE OF LOOSE SCALE AND RUST . IMMEDIATELY PRIOR TO PAINTING SHALL BE THOROUGHLY CLEANED AND TREATED WITH PHOSPHATE TO FORM A CORROSION RESISTANT CONVERSION FILM AT THE SURFACE AND TO IMPROVE PAINT BONDING .

THE FINISH SHALL CONSIST OF ONE COAT OF EPOXY RED OXIDE PRIMER AND TWO COATS OF STOVED ENAMEL COMPATIBLE WITH SPECIFIED ENVIRONMENT (E.G. FLAT OR SEMI – GLOSS , DARK GREY) .

ANY OTHER FINISH PROCEDURE SHALL BE SPECIFIED BY VENDOR AT THE QUOTATION STAGE AND SHALL BE SUBJECT TO N.I.G.C ENGINEER APPROVAL .

THE ENCLOSURE SHALL BE TAMPER PROOF AND PROTECT THE INTERIOR COMPONENTS AND ACCESSORIES FROM WEATHER , VERMIN AND VANDALISM . OIL RESISTANT AND COMPRESSABLE , POSITIVE SEALING LID GASKET SHALL BE PROVIDED WHEREVER APPLICABLE . ALL GASKETS SHALL BE IMPERVIOUS TO SERVICE CONDITIONS . THE WINDOWS OF ALL METERING EQUIPMENTS SHOULD HAVE SAFETY GLASS COVER THE ENCLOSURE SHALL

HAVE HEAVY DUTY LOCKING DEVICE TO PREVENT UNAUTHORIZED OPENING OF FRONT COVER OR CONTROL DEVICES CHAMBER PROVISION SHALL BE MADE FOR FIXING SUNSHADES TO THE TANK ON SITE .

6. TRANSFORMER ;

THE TRANSFORMER SHALL BE OF TWO WINDING (SEPARATE PRIMARY AND SECONDARY) , OIL IMMERSED OR DRY TYPE DEPENDING ON RELEVANT

REQUISTITION AND/OR DATA SHEET THE TRANSFORMER SHALL BE PROVIDED WITH THREE PRIMARY TAPS CORRESPONDING TO 10% OF THE NOMINAL INPUT VOLTAGE . ELECTRICAL SHIELD BETWEEN PRIMARY AND SECONDARY TRANSFORMER WINDING CONNECTED DIRECTLY TO THE ENCLOSURE EARTHING LUG . THE TRANSFORMER SHALL BE CAPABLE OF CONTINUOUS OPERATION AT THE SPECIFIED FULL LOAD CAPACITY UNDER SUMMER SERVICE CONDITIONS WITHOUT EXCEEDING THE FOLLOWING TEMPERATURE RISE LIMITS .

WINDING TEMPERATURE RISE MEASURED BY RESISTANCE .

FOR OIL IMMERSED TYPE 65°C AND FOR DRY TYPE 60°C .

TOP OIL TEMPERATURE RISE MEASURED BY THERMOMETER 55°C .

ALL TRANSFORMER INSULATION SHALL BE RATED FOR A MINIMUM OF 130°C (CLASS B) OR BETTER . EXTRA INSULATION SHALL BE APPLIED AT ALL POINTS OF STRESS SUCH AS TAP CONNECTIONS AND ADJACENT TO CORE . ALL INSULATION MATERIALS SHALL WITHSTAND 2500 VOLTS RMS VALUE AT 50 HZ APPLIED FOR ONE MINUTE BETWEEN THE WINDING AND CORE . THE TRANSFORMER EFFICIENCY SHALL BE NOT LESS THAN 95% .

7. RECTIFIER :

THE RECTIFIER STACK ASSEMBLY SHALL BE PROTECTED BY FAST ACTION SEMI – CONDUCTOR FUSES AND COMPOSED OF SILICON DIODES OR ANY SEMI – CONDUCTORS HAVING OVERALL EFFICIENCY OF NOT LESS THAT 90%

RECTIFIER CIRCUIT TYPE SHALL BE FULL WAVE BRIDGE ARRANGEMENT . THE DIODES SHALL BE OF THE DIFFUSED JUNCTION TYPE OR EQUAL AND RATED TO PROVIDE ADEQUATE ,MARGIN FOR OVER VOLTAGE SURGES AND OVER – CURRENT SURGES IN ADDITION , SILICON DIODES SHALL BE PROTECTED BY SELENIUM SURGE - PLATEST AGAINS OVER - VOLTAGE SURGES AND BY CURRENT – LIMITING DEVICES AGAINST OVER – CURRENT SURGE HEAT SINK SHALL BE SIZED TO KEEP DIODE JUNCTION AND BASE TEMPERATURES WELL BELOW THE MAXIMUM TEMPERATURES RECOMMENDED BY THE MANUFACTURER .

EACH STACK ASSEMBLY SHALL BE CLEARLY MARKED WITH AN APPROPRIATE RATING AND ASSEMBLED CODE . ASSEMBLED STACK SHALL BE SUBJECTED TO 2500 VOLTS A.C. 50 HZ. TEST POTENTIAL APPLIED BETWEEN EACH OF THE

ELECTRICAL TERMINALS AND THE MOUNTING STUDS . STACKS SHALL BE COATED WITH CORROSION RESISTANT FINISH .

8. ELECTRICAL COMPONENTS :

8.1 SWITCH FUSE

SINGLE POLE AND NEUTRAL OR THREE PHASE AND NEUTRAL AS SPECIFIED ON DATA SHEET FITTED WITH HRC CARTRIDGE FUSES . SUITABLY RATED FOR OPERATION UNDER FULL LOAD CONDITIONS .

8.2 SWITCH FUSE ENCLOSURE (OUTSIDE OF TR. REC.)

METAL – CLAD , NON CORROSIVE MATERIAL , SURFACE MOUNTING , BUTTON ENTRY , IP 54 WITH LOCKING FACILITY , PROVIDED WITH EARTHING SCREW AS SPECIFIED ON DATA SHEET .

8.3 TIME SWITCH

A REPETITIVE INTERVAL TIMER OF DURATION " 2 MINUTES ON - 3 MINUTES OFF " SHALL BE FITTED COMPLETE WITH TIMER ON/OFF SWITCH , FUSE PROTECTION AND CONTACTOR SUITABLE FOR FULL LOAD RATING . THE TIME SWITCH SHALL BE SO ARRANGED AS TO ENABLE A SELECTION OF EITHER CONTINUOUS OPERATION OR TIME SWITCH CONTROLLED OPERATION OF THE TR.REC. UNIT .

8.4 L.V. LIGHTNING ARRESTER CONNECTED ACROSS AC TERMINALS .

8.5 DC OUTPUT

IN ADDITION TO HIGH SPEED OFF – SET TAGS FUSES SPECIALLY DESIGNED TO MATCH THE CHARACTERISTIC OF DIODS , ACCORDING TO IEC 269 – 4 AND / OR BS 88 – 4 , THE RECTIFYING STACK SHALL BE PROTECTED BY ONE AND / OR BOTH OF THE FOLLOWING OPTIONS SPECIFIED AT THE ENQUIRY STAGE REFER TO DATA SHEET .

8.5.1 THE TR. REC EFFICIENCY SHALL BE NOT LESS THAN 80% .

8.6 MEASURING INSTRUMENTS

SEPARATE MOVING COIL DC AMMETER WITH SHUNT AND DC VOLTMETER SHALL BE PROVIDED FOR MONITORING THE RECTIFIER OUTPUT . THE VOLTMETER SHALL BE PROTECTED BY FUSES A RED LINE SHALL INDICATE THE MAXIMUM OUTPUT RATINGS .

8.7 CONNECTION AND WIRING

8.7.1 ALL METAL COMPONENTS OF THE TR. REC UNIT SHALL BE CONNECTED TO CLEARLY MARKED EARTHING TERMINAL AND EXTERNAL EARTHING LUG PROVIDED ON TR. REC UNIT .

8.7.2 ALL TERMINALS SHALL BE EQUIPPED WITH LUGS FOR EASY CONNECTION AND EASY DISCONNECTION OF CABLES AND WIRES . THEY SHALL BE CLEARLY MARKED AND IDENTIFIED ACCORDING TO THE RELEVANT ELECTRICAL DIAGRAM .

8.7.3 ALL ACCESSURIES USED IN ELECTRICAL CONNECTIONS INCLUDING BOLTS , STUDS , NUTS , WASHERS AND LOCKWASHERS SHALL BE OF NON CROSSIVE METAL WITH HIGH CONDUCTIVITY .

8.7.4 ALL CONNECTIONS , EITHER ELECTRICAL OR MECHANICAL SHALL BE TIGHTLY SECURED WITH LOCKWASHERS , OR OTHER POSITIVE LOCKING DEVICES .

8.7.5 ALL INTERNAL WIRING SHALL BE HIGH CONDUCTIVITY , MULTISTRANDED COPPER CONDUCTORS OF MIN . CROSS – SECTION 1.5MM . SQ. SUITABLY INSULATED TO WIHTSTAND PROLONGES MAXIMUM TEMPERATURE WITHIN THE TRANSFORMER – RECTIFIER AT FULL – LOAD AND OF PROPER LENGTHS TO AVOID TENSION AT TERMINALS .

8.7.6 ALL INTERNAL WIRING ENDS AND TERMINALS SHALL BE CLEARLY MARKED FOR EASY IDENTIFICATION AND

REFERENCE WITH THE CORRESPONDING WIRING DIAGRAM OF TR.R. UNIT .

8.8 OIL IMMERSED TR.REC. ACCESSORIES

8.8.1 SILICAGEL BREATHER .

8.8.2 DIAL TYPE THERMOMETER .

8.8.3 OIL SIGHT GAUGE .

8.8.4 OIL FILLER AND DRAIN PLUG .

8.8.5 OIL LEVEL INDICATOR OR DIPSTICK .

9. NAME PLATES AND LABLES

9.1 NAME PLATE OF NON – CROSSIVE METAL SHALL BE FIXED TO THE ENCLOSURE WITH FOLLOWING DATA ALL IN ENGLISH LANGUAGE :

NAMEPLATE :

MANUFACTURER		DATE
MODEL NO.	SER.NO.	ORDER NO.
A.C. VOLTS	AC.AMPS.	PHASE FREQ.
MAX OUTPUT : DC VOLTS		DC.AMPS
DESIGN AMB.TEMP.		MAX.OIL TEMP

9.2 THE LABELS FIXED INSIDE CUBICLE SHALL BE MADE FROM " IVORINE " OR OTHER EQUIVALENT MATERIAL .

1. ONLY FOR OIL IMMERSED TR.REC .

10.QUALITY TESTING AND ASSURANCE :

THE TRANSFORMER – RECTIFIER SHALL BE TESTED IN ACCORDANCE WITH THE REQUREMENTS OF ALL SECTION CONTAINED HEREIN .

ALL ANCILLARY EQUIPMENT AND MATERIALS FORMING PART OF THE TRANSFORMER – RECTIFIER UNIT SHALL COMPLY WITH THE RELEVANT CURRENT REQUIREMENTS OF THE APPLICABLE BRITISH STANDARDS AND/OR THEIR EQUIVALENT OF IEC SPECIFICATIONS THE TRANSFORMER – RECTIFIER UNIT SHALL BE SUBJECT TO INSPECTION BY N.I.G.C. ENGINEER OR APPOINTED

REPERESENTATIVE , WHICH SHALL CONSIST OF , BUT SHALL NOT NECESSARILY BE LIMITED TO :

A. TYPE TESTS

THE MANUFACTURER OR SUPPLIER SHALL MAKE AVAILABLE CERTIFICATES OF THE TESTS SHOWING COMPLIANCE , WHERE APPLICABLE WITH THE STANDARDS LISTED IN CLAUSE OF THIS STANDARD SPECIFICATION . AT THE DISCRETION OF THE N.I.G.C. ENGINEER EVIDENCE OF TYPE TESTS MAY BE ACCEPTABLE IN LIEU OF ACTUAL TESTS .

B. ROUTINE TESTS

THE TR. REC. UNIT SHALL BE SUBJECT TO A COMPLETE PHYSICAL INSPECTION AND ROUTING TEST ON ALL EQUIPMENT , WHERE APPLICABLE AS FOLLOWS :

1. RATIO AND POLARITY TEST .
2. NO – LOAD LOSSES
3. VOLTAGE PRESSURE TEST (AT 2K.V. FOR ONE MINUTE)
4. INSULATION RESISTANCE TEST
5. LOAD TEST
6. EFFICIENCY TEST
7. FUNCTIONAL TEST

NOTE : ANY OTHER TEST DEEMED NECESSARY BY N.I.G.C REPERESENTATIVE / INSPECTOR .

11.SPARES :

SUPPLIERS SHALL PROVIDE THE REQUIRED SPARE PARTS ON N.I.G.C REQUEST FOR A PERIOD OF 10 YEARS SINCE THE PRCHASING DATE .

12. DOCUMENTATION / LITERATURE

12.1 AT THE QUOTATION STAGE

MANUFACTURERS OR SUPPLIERS ARE TO PROVIDE 3 COPIES OF THE FOLLOWING :

A. COMPLETE TECHNICAL SPECIFCATION AND ELECTRICAL DIAGRAMS .

B. DEPARTURES , IF ANY , FROM THE N.I.G.C. STANDARD REQUIREMENTS SHEET AND/OR STANDARDS SPECIFIED HEREIN WITH ALTERNATIVE PROPOSALS AND / OR RECOMMENDATION WITH REASONS .

C. PRELIMINARY ARRANGEMENT DRAWING WITH PRINCIPAL DIMENTIONS AND MASS .

D. SUPPORTING TECHNICAL LITERATURE .

12.2 AT THE ORDERING STAGE :

MANUFACTURERS OR SUPPLIERS ARE TO PROVIDE 3 COPIES FOR EACH TYPE OF THE FOLLOWING AT THE TIMES OF ON THE ORDER :

A. FINAL CERTIFIED TECHNICAL SPECIFICATION .

B. FINAL DETAILED CIRCUIT DIAGRAM .

C. OPERATING AND INSTALLATION INSTRUCTIONS .

D. MAINTENANCE MANUALS INCLUDING WIRING DIAGRAM (S) .

E. ITEMISED SPARE PARTS LIST .

F. INSPECTION AND TEST CERTIFICATES .

ALL THE ABOVE LISTED DOCUMENTATION DRAWINGS AND LITERATURE WHICH MUST BE IN THE ENGLISH LANGUAGE AND INDICATE ALL DIMENTIONS , CAPACITIES , ETC ., IN METRIC UNITS)

ARE CONSIDERED AS A PREREQUISITE FOR FINAL ACCEPTANCE AND INVOICE FOR APPROVAL .

THE ORDER NO : MUST BE PROMINENTLY SHOWN ON ALL DOCUMENTS .

Transformer Rectifire for Cathodic Protection		
Technical Data Sheet		
Project Title :		
Indent No. :		
Date :		
Service Condition	**As Per Standard No. : IGS-MS-EL-013(2): 1998**	
Electrical Characteristic :	**AC Input :**	**DC Output :**
	Single Phase , 220 VOLTS, 50 Hz	☐ 75 VOLTS, 25 AMPS
		☐ 50 VOLTS, 15 AMPS
		☐ 25 VOLTS, 10 AMPS
		☐ .....
	Three Phase , 380 VOLTS, 50 Hz	☐ 100 VOLTS, 100 AMPS
		☐ 100 VOLTS, 50 AMPS
		☐ 50 VOLTS, 50 AMPS
		☐ .....
Output Control	**Setting**	☐ STEP
		☐ CONTINOUS
		☐ BOTH
Type of Transformer	☐ Oil Immersed together with Oil Filling	
	☐ Dry Type	
Equipment Control & Protection	**AC Circuit :**	
	Switch Fuse with Enclosure	**Switch Fuse without Enclosure**
	☐ Single Pole & N	☐ Single Pole & N
	☐ Triple Pole & N	☐ Triple Pole & N
	☐ Lightning Arrester	
	DC Circuit :	
	☐ Lightning Surge Diverter	
	☐ Transient Suppression	
	☐ Increased Efficiency Filter	
	☐ Noise Interference Filter	
	Current Regulation :	
	☐ Thyristor	
	☐ Other	
Mounting	☐ Wall Mounted	
	☐ Pole Mounted	
	☐ Plinth Mounted	