TECHNICAL SPECIFICATION FOR MACHINE ROOM BLOWER INCLUDING MOTOR FOR THREE PHASE ELECTRIC LOCOMOTIVES

SPECIFICATION NO. - CLW/ES/3/0020/I

ENCLOSURES:

A) DRG. NO

(i) CLW/ES/3/SK-1/0020/I

(ii) CLW/ES/3/SK-2/0020/I

(iii) CLW/ES/3/SK-3/0020/I

(iv) CLW/ES/3/SK-4/0020/I

(v) CLW/ES/3/SK-5/0020/I

B) Specification Nos.:-

i) RDSO specification No-E-10/3/09 (Motor) with amendment no-1 to 6 (For Motor)

ii) CLW Specification No.: CLW/ES/3/0455 (for blower)

ISSUE DATE: 09.07.2001

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ISSUED BY:

DY. CHIEF ELECTRICAL ENGINEER/D-III
CHITTARANJAN LOCOMOTIVE WORKS
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DETAILS OF ALTERATIONS

Amend No.	Date of amendment	Page No.	Alteration	Reason	Authority
1	01.04.1998	04, 05, 06	A	Change Clause 1.2, single phase to 3-phase. Ambient temperature changed from 47°C to 55°C. Added additional point of standard in Clause 3, additional technical data of motor & blower added at Clause No. 4.1 & 4.2.	S/D
2	16.03.2001	09	B	Scope of supply, RDSO's instruction for firm's in-house balancing & Note to the firm added at Sheet No. 9.	S/D
3	09.07.2001		C	The specification has been revised completely and details of test procedure has been deleted and reference has been made to CLW/ES/3/0454 & CLW/ES/3/0455 which gives the details of testing procedure as per RDSO's instructions.	S/D
4	04.03.2002	11	D	Existing plug & socket arrangement deleted. One additional motor terminal box with terminal plate added.	S/D
5	11.12.2002	11	E	Note: - 7) added at Sheet No. 11.	S/D
6	14.02.2003	9, 11	F	i) Note: - 8) & 9) added at Sheet No. 11 as per RDSO Letter No. EL/3.2.176/2 dtd. 03.02.2003. ii) Note: - 4) added at Sheet No. 9.	S/D
7	09.01.2014	11	G	Hole diameter has been increased from 14mm to 16mm at Sheet No. 11 as per approval of CEE/LOCO, Letter No. ELDD/3716 dtd. 25.11.2013.	S/D
8	03.03.2022	1, 5, 6, 9, 16	H	1) At Sheet No. 1, SK-6 deleted. 2) At Sheet No. 5, 6 and 9 Capacitor has been deleted. 3) At Sheet No. 6 Rated Voltage has been added. 4) At Sheet No. 16, CLW/ES/3/SK-6/0020 has been deleted.	S/D
9		9	I	Warranty Clause included	S/D

NOTE: "Specifications have been digitized and all alterations have been incorporated"

INDEX

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SPECIFICATION FOR MACHINE ROOM BLOWER INCLUDING MOTOR

1. SCOPE

1.1 This specification applies to Machine Room Blower including Motor for25KV AC 50 HZ 3-phase locomotive. Quantity per loco - 02 nos.

1.2 Machine Room Blower powered by 3-phase motor.

2. CLIMATE AND ENVIRONMENT CONDITIONS:-

* Maximum Atmospheric Temperature		: Under Sun : 70°C In shade : 50 °C
* Humidity		: 100% saturation during rainy season
* Ambient temperature		: -10 to +55 °C (motor in air flow)
* Humidity	normal	: 60%
	maximum	: 100% (during rainy season)
* Altitude	normal	: 160 m above mean sea level
* Cooling		: Power dissipation in air flow.

Locomotive and equipment will be designed to work in coastal areas (humid and salt laden atmosphere and in desert areas (extremely dusty).

3. STANDARDS:

IEC standard publication 34-1/ Rotating electric machine, Part, <Rating and Performances.
IEC Standard Publication 34-5 Part 5, Classification of degrees of protection provided by enclosures for rotating electric machines (IP-Code).
IEC 34-6/1991/Part 6: Methods of cooling (IC-Code).
IEC 34-8/1972/Part 8 : Terminal markings and direction of rotation of rotating machines.
IEC 38/1983: IEC Standard Voltages.
IEC 72-1/1991: Dimensions and output series for rotating electric machines.
IEC 85/Second edition 1984 Thermal evaluation and classification of electric insulation 2.1. Thermal classes Part 1 : Flame numbers 56 to 400 and flange numbers 55 to 1080.
IEC 349-2/1993-3/First edition/pages 39 formula. Group 1 <Insulation test voltages.
IS 325/1991/specification for three phase induction motors, Rating and Performance.
IS 2223-1983: Dimension of three phase flange mounted induction motors.
IS 4029/1991/Guide for testing three phase induction motors.
IS:13730 (Pt.8)/1993/specification for polyesterimide enamelled round copper winding wires with temperature class 180.

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IS 1370pt-13-'93 (Pt.13)/specification for dual coated enameled round copper wires with temperature class 200.
IS 11184/1984/Enamelled and varnish bonded glass fiber covered round copper wires.
IEC 77/1968 – Rules for electric traction equipment.
IEC 165/1973: Rules for testing electric stock on completion of construction and before entry into the service.
IEC 34-G/1991/Part/6: Method of cooling (IC-code).
IEC 85/1984/Thermal evaluation and classification of electric insulation.
IEC 349-2/1993-3/formula, Group-1 insulation test voltage.
IS:4691-1985 & IEC 34-5-1981: Degree of protection provided by enclosures for rotating electrical machinery.
IS:12075-1991: Mechanical vibration of rotating electrical machines.
IEC 34-1-Part-1: Rating & performance of rotating electrical machines.
IEC 34-8/1972: Terminal marking and deduction of rotation of rotating machines.
IEC 38/1983: IEC standard voltage.
IEC 72-1/1991: Dimension and output series for rotating electric machines.
IEC 77/1968: Rules for electric traction equipment.
IEC 165/1973: Rules for testing electric stock on completion of construction and before entry into the service.
IEC 2223-1983: Dimensions of 3-phase flange mounted induction motor.

4. TECHNICAL DATA: -

4.1 **Nominal Motor data:**

Motor	: 3 KW /2pole flange mounted, frame size – 132 M
Nominal mechanical power	: 2.4 KW
Power consumption	: 2.8 KW
Voltage nominal	: 415 V
Voltage variation	: +10% -24%
Voltage variation short time	: -24% +10%
Frequency nominal	: 50 Hz
Efficiency	: ≥ 80%

3-phase motor will run on 3-phase 415±10% power supply

Power factor	: 0.95
Class of protection	: IP 54/55
Class of insulation	: H class with VPI
Weight of motor	: 80 Kg approx.
Speed of motor	: 3000 r.p.m. (SYNCHRONOUS)
Type of enclosures	: TESC
Type of Bearing	: ~~DE = 6208 (open type), NDE = 6208 (open type) to be used. Only SKF/FAG (imported) bearing shall be used~~. Firm may use sealed bearing or

higher size bearing however firm needs to get their drawing approved, vendors may also suggest any change in BOM to get better quality.

4.2 **Details of Machine Room Blower: -**

Reference Drg. No. CLW/ES/3/SK-2/0020

Number of blowers per loco	: 02
Max. speed of blower	: 2950 r.p.m.
V1 air flow (M^3/sec.)	: 1
Total air flow ((M^3/sec.)	: 2
Pressure drops (pa)	
Δp1 strata-panel -filter	: 570
Δp2 Air duct filter-blower	: 31
Δp3Air duct filter-blower	: 374
Weight gross	: 140 Kg. Approx.
Type of bearing DE & NDE	: 6208 (open type to be used)
Static pressure (pa)	: 1380
Dynamic pressure (pa)	: 10
Total pressure (pa) at 20°C	: 1390
Type of Blower	: mixed flow
Blower type	: 415-60
P mech (KW)	: 2.55
Normal shaft power (KW)	: 2.60
Weight of motor	: 80.0 Kg. approx.

Rated voltage 3-ph., 415±10%, 50 Hz.

The temperature rise limits for the blower motor will be reduced in comparison with the limits given in the IEC standard to take care of the higher ambient temperature in India. Only insulation system of class 'H' will be acceptable. The permitted temperature rise of the motor windings will be –

Δ = Specified temp. rise of class 'H' insulation minus 65°C

Δ = 145°C - 65°C = 80°C

Max. Bearing temp. rise = 30°C

Vacuum pressure impregnation of the stator winding has to be done as per the Indian Railway requirement.

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5. TESTS: - TYPE TEST & ROUTINE TEST

Tests are classified as type test and routine tests.

5.1 TESTS ON MOTOR: **For Type test and Routine Test: Refer to RDSO Specification No. E-10/3/09 (Motor) with amendment no-1 to 6 or latest)**

A. Type Tests: - (To be conducted on Prototype Motors)

- Resistance Measurement
- Direction of rotation
- No Load Test
- Locked Rotor Test
- Pull Up and Pull-Out Torque Test
- Load Test
- Temperature Rise Test
- Over Speed Test
- High Voltage Test
- Surge Test
- Vibration Test
- Starting Test
- Measurement of “Noise Level”
- Visual and Dimensional check

B) Routine Tests :-

- Resistance Measurement
- Direction of Rotation
- No Load Test
- Locked Rotor Test
- Temperature Rise Test
- High Voltage Test
- Vibration Test
- Surge Test
- Visual and dimensional Check

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5.2 TESTS ON BLOWER: - (For Detail Type test and Routine Test refer to CLW Specification No. CLW/ES/3/0455 or latest)

A) Type Tests: -

- Air delivery test
- Starting time test
- Starting Duty test
- Endurance test
- Vibration level test
- Weighment
- Checking of bearing by shock pulse meter
- Checking of dimensions workmanship, clearance of impeller fixing and locking arrangement. Intensity of sound in decibel.
- Starting Current, Running Current at i) 373V 33 Hz. (ii) 415V, 50 Hz. – to be recorded

B) Routine Tests: -

- Checking of obligatory dimensions and clearance of impeller fixing and locking arrangement.
- Starting time test
- Vibration level test
- Condition of bearing by shock pulse meter

For Details of type test and routine test of Blower please refer specification No. CLW/ES/3/0455.
Vibration level in microns when blower is discharging its rated delivery at rated pressure & voltage.
Motor : 10 microns max.
Blower : 15 microns max.

6. OPERATING CONDITON: -

Operating time: -

Daily approx.	: 16 hrs. (approx. 330 days per year)
Yearly approx.	: 5280 hrs.
Within 30 years approx.	: 158400 hrs.
Life time under current maintenance	: 30 years

6.1 According to chapter “environmental conditions” the MTBF of 1 motor shall be at least 20,000 hrs. The lifetime of bearings shall be at least 20,000 hrs.

7. NAME PLATE: -

i) Manufacturer’s name, type & serial number

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ii) Air delivery
iii) Rated speed & rated current
iv) Make of the motor
v) Power consumption in KW
vi) Impeller diameter
vii) Weight
viii) Manufacturing date & year
ix) Arrow for direction of rotation and direction of airflow to be provided

8. SCOPE OF SUPPLY: -

FOR DETAILS REFER DRG. NO. CLW/ES/3/SK-2/0020 & CLW/ES/3/SK-3/0020

Sl. No.	Description	Qty.
i)	Motor – 3-phase, SQ. TESC 415V±10%, 50 Hz, 2 pole, Frame size 132 M, 3 KW, 'H' class insulation, flange mounted	01 no.
ii)	Blower housing	01 no.
iii)	Inlet cone with flange	01 no.
iv)	Impeller	01 no.
v)	Flexible conduit from motor terminal box to plug & socket	01 no.
vi)	Wiring cables – Red, Yellow, Blue & Earth. From motor terminal box to motor terminal box on casing duly crimped with cable lug & connected with heat shrinkage insulating sleeve.	01 set
vii)	Name plate, Direction of rotation & Direction of air flow made of "Al". to be riveted on blower housing.	01 set
viii)	Motor Terminal Box with Terminal Plate suitable for 3 KW, 415V motor RDSO approved design.	01 no.

9. Warranty: The supplier must give a clear warranty for a period of 42 month from the date of Supply or 36 Month from the date of commissioning in locomotives whichever is earlier.

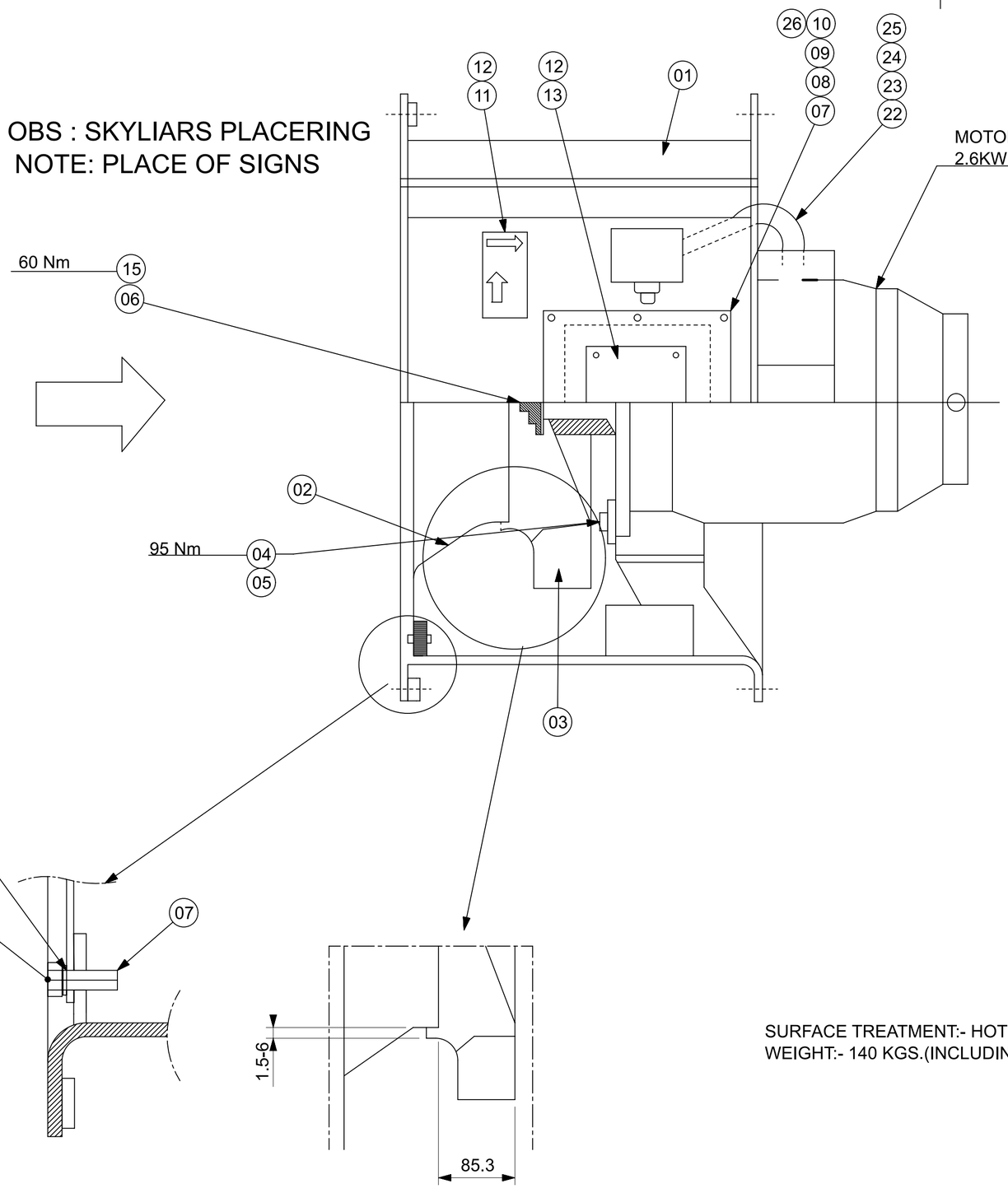
NOTE TO THE FIRM

1) The firm should have in house facility for separate and combined balancing of motor, impeller and complete assembly to grade G 2.5 of ISO:1940 as per RDSO's Letter No. EL/3.2.14 dtd. 12.03.2001.
2) All hardware and fasteners are to be used from UVAM Approved/Developmental source only:
3) All non-metallic parts of Machine Room Blower including motor should be fire retardant and self-extinguishing properties as per IS:11731 (Part-I and Part-II) or any other equivalent DIN, IEC standard.

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OBS : SKYLIARS PLACERING
NOTE: PLACE OF SIGNS



TORQUE BY HAND CRAFT

GASKET ITEM 10 WILL BE GLUED TO THE INSPECTION COVER
SURFACES WILL BE SEALED BY SEALING COMPOUND(NOT SILICONE)

SURFACE TREATMENT:- HOT DIP GALVANISED.
WEIGHT:- 140 KGS.(INCLUDING MOTOR)

ALL DIMENSIONS IN mm

16	26	BRICKA/WASHER	SRB 3X9X35
1	25	BRICKA/WASHER	DIN 128/A6
1	24	MUTTER/NUT	ISO 4032-M6-8FE/ZN25
1	23	SKRUV/SCREW	ISO4017-M6X16-8.8 ZN 25
1	22	KLAMMER/CLAMP	ALENTEC TYP RSCUT.28/15
1	15	ANDBRICKA/END WASHER	
1	13	SKYLT/SIGN	
8	12	SKRUV/SCREW	SMS1549 KDS NR 2 X 6
1	11	SKYLT/SIGN	
1	10	PACKNING/GASKET	
16	9	BRICKA/WASHER	DIN 128/A8
16	8	SKRUV/SCREW	ISO4017-M8X25-8.8 Zn45
16	7	NIT MUTTER/RIVET NUT	RIVEKLE 2330.1 M8 ZN
1	6	SKRUV/SCREW	ISO 4017-M10X40-8.8Zn 45
4	5	BRICKA/WASHER	
4	4	SKRUV/SCREW	ISO 4017-M12X30- 8.8 Zn 45
1	3	HJUT/IMPELLER	
1	2	INLOPP/INLET	
1	1	KAPA/CASING	

निर्देश संख्या REF. NO.	अंग आरेखण संख्या PART DRG. NO.	वर्णन DESCRIPTION	मात्रा QTY.	पदार्थ MATL	विशिष्टि SPECN	प्रति भार कि. ग्रा. WT. EACH IN K.G.

धातु–वेल्डन चिन्ह
भा. मा. : 813 / अ. मा. सं. :2553
WELDING SYMBOLS TO IS:813 / ISO:2553

सतह – रुक्षता का मान
भा. मा. 3073 / अ. मा. सं. 1302
SURFACE ROUGHNESS VALUE TO IS:3073 / ISO:1302

अनिर्दिष्ट सह्य – सीमा भा. मा. : 2102 / अ. मा. सं. : 2768
UNSPECIFIED TOLERANCE TO IS : 2102 / ISO : 2768

ग्रेडांक GRADE NO.	सं1 N1	सं2 N2	सं3 N3	सं4 N4	सं5 N5	सं6 N6	सं7 N7	सं8 N8	सं9 N9	सं10 N10	सं11 N11	सं12 N12
Rz	0.16-0.3	0.5-0.7	0.9-1.1	1.5-2.0	2.5-3.8	5.0-6.3	9.0-12	16-25	30-40	50-63	75-100	160-250
Ra μm	0.025	0.05	0.1	0.2	0.4	0.8	1.6	3.2	6.3	12.5	25	50
चिन्ह SYMBOL												

TOL. CLS.

परिवर्तन संख्या ALT. NO.	प्राधिकार AUTHY	वर्णन DESCRIPTION	दिनांकित आद्याक्षर DATED INITIAL

अभिकल्पित DGN	
जाँचा व.अ.अ. CHD SSE	
समीक्षित व.वि.अ. / व.वि.अ. REVIEWED AEE / SEE	
अनुमोदित उ.मु.वि.अ. APPROVED DYCEE	
दिनांक DATE	
रेखिक अनुपात SCALE	NTS

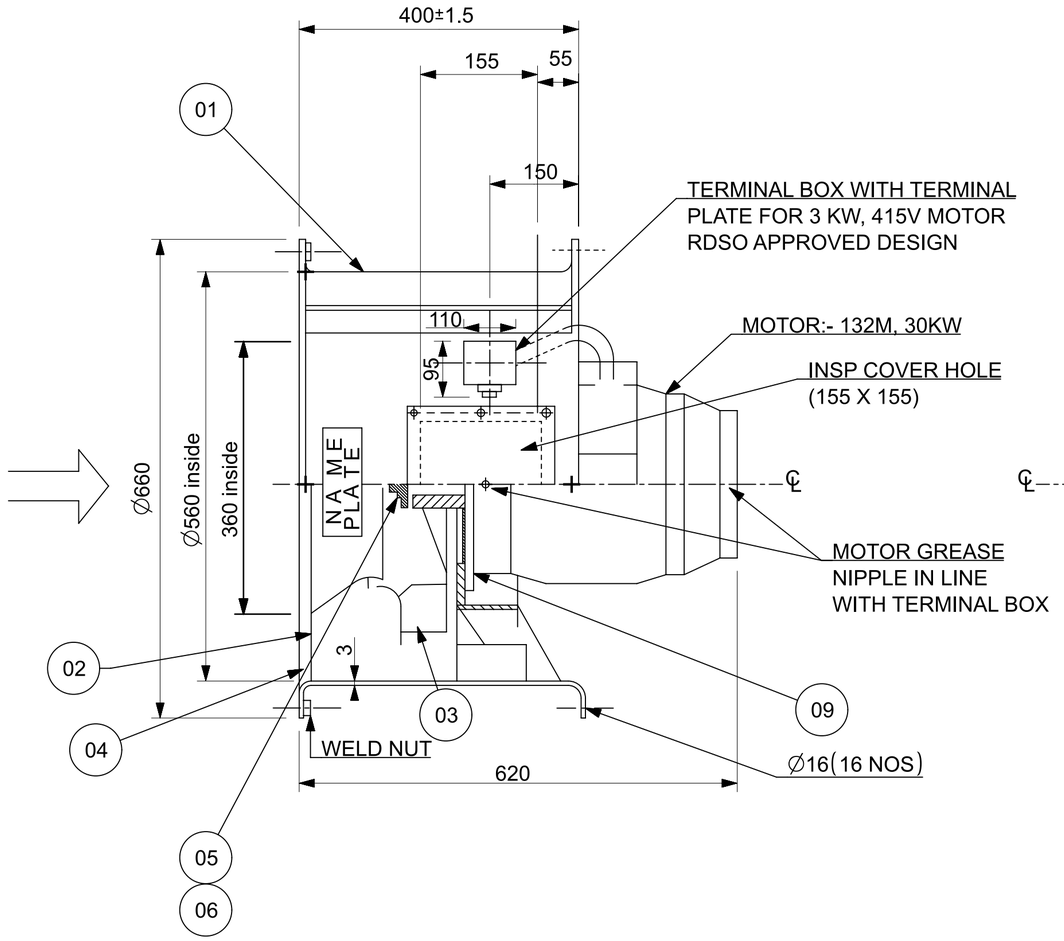
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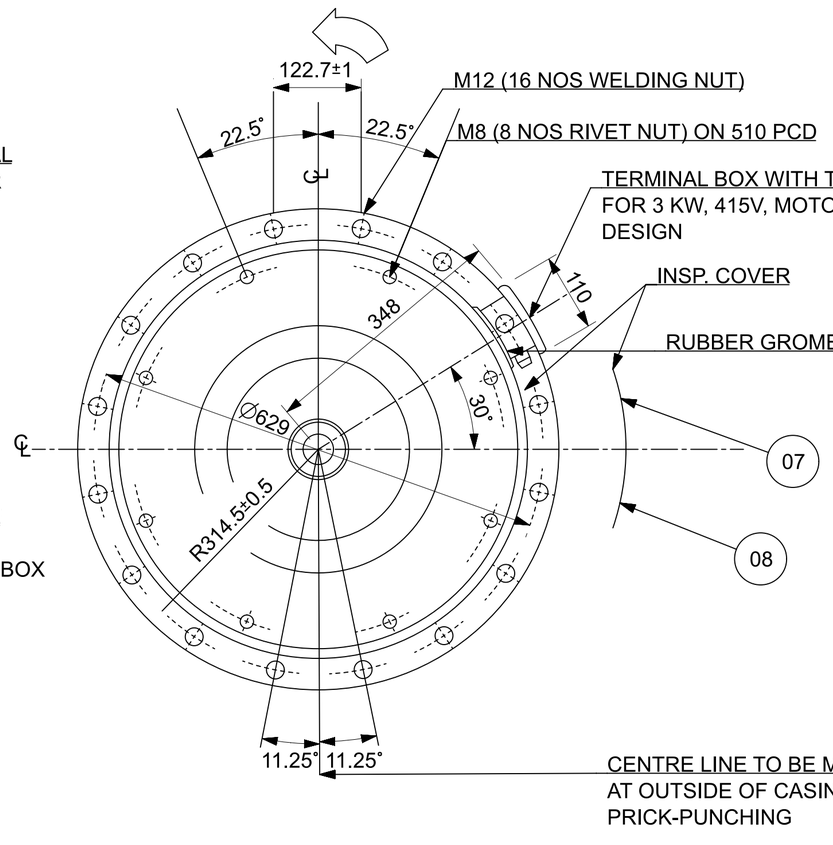
चित्तरंजन रेलइंजन कारखाना
CHITTARANJAN LOCOMOTIVE WORKS, INDIA

पदार्थ MATL	प्रति भार कि. ग्रा. WT. EACH IN KG
विशिष्टि SPECN	
वर्णन DESCRIPTION	SPECIFICATION FOR MACHINE ROOM BLOWER INCLUDING MOTOR
आरेखण संख्या DRAWING NO.	CLW/ES/3/SK-1/0020/1
परिवर्तन संख्या ALTERATION NO.	पृष्ठ SHEET 1 OF 1 — A2

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NOTE :-

1. INSPECTION COVER FIXING NUTS TO BE WELDED ON CASING PROPERLY.
2. INSPECTION COVER TO BE FIXED ON CASING WITH OIL AND HEAT RESISTANT NEOPRENE RUBBER GASKET 3 MM THK., SHORE HARDNESS:-50±5 WITH SIKAFLEX.
3. MOTOR GREASE NIPPLES ON DE & NDE SHOULD LIE IN ONE LINE AND SHOULD BE ACCESSIBLE FROM INSPECTION DOOR. MOTOR TERMINAL BOX SHOULD BE IN FRONNT OF INSP-DOOR.
4. R,Y,B & E (EARTH) TERMINAL LEADS ARE TO BE BROUGHT FROM MOTOR TERMINAL BOX TO ADDITIONAL MOTOR TERMINAL BOX ON CASING THROUGH NON-METALLIC FLEXIBLE CONDUIT (HALOGEN PROOF) WITH SUITABLE CABLE LUGS PROPERLY CRIMPED AND INSULATED WITH HEAT SHRINKAGE SLEEVES.
5. P.C.D ∅629 MM AND OFF-SET ANGLE 11.25°TO BE MAINTAINED WHILE DRILLING HOLES & WELDING NUTS ON CASING FLANGES WITH JIG. THEY SHOULD LIE IN ONE LINE.
6. COMPLETE CASING & INLET CONE ARE TO BE HOT DIP GALVANIZED.

NOTE:-

7. DIRECTION OF ROTATION, DIRECTION OF AIR FLOW AND NAME PLATE TO BE RIVETTED ON BLOWER HOUSING ARROWS FOR DIRECTION OF ROTATION & DIRECTION OF AIR FLOW TO BE PAINTED RED.
8. IMPELLER HUB SHOULD HAVE PUNCH MARK INDICATING MAKE & YEAR OF MANUFACTURE.
9. IMPELLER SHOULD HAVE SERIAL NO. OF CASING AND MAKE PAINTED ON THE BACK PLATE OF IMPELLER.

निर्देश संख्या REF. NO.	लागत एवं वितरण संख्या C&D NO.	अंग आरेखण संख्या PART DRG. NO.	वर्णन DESCRIPTION	मात्रा QTY.	पदार्थ MATL	विशिष्टि SPECN	प्रति भार कि. ग्रा. WT. EACH IN K.G.
09		2028-1536	SCREW M12X50	4			
08		2028-1453	SCREW M8X25	8			
07		V2598503-0109	INSP. DOOR	1			
06		2028-1499	SCREW M10X40	1			
05		V3609770-1100	END WASHER	1			
04		2028-1453	SCREW M8X20	8			
03		V2598180-0100	IMPELLER-2.5 THK	1			
02		V2598199-0100	INLET-2THK.	1			
01		V2598503-0100	CASING-3THK.	1		IS-1079 GR.-0	

धातु–वेल्डन चिन्ह भा. मा. : 813 / अ. मा. सं. :2553 WELDING SYMBOLS TO IS:813 / ISO:2553	सतह – रुक्षता का मान भा. मा. 3073 / अ. मा. सं. 1302 SURFACE ROUGHNESS VALUE TO IS:3073 / ISO:1302

अनिर्दिष्ट सद्य – सीमा भा. मा. : 2102 / अ. मा. सं. : 2768 UNSPECIFIED TOLERANCE TO IS : 2102 / ISO : 2768												TOL. CLS.
पदांक GRADE NO.	सं1 N1	सं2 N2	सं3 N3	सं4 N4	सं5 N5	सं6 N6	सं7 N7	सं8 N8	सं9 N9	सं10 N10	सं11 N11	सं12 N12
Rz	0.16-0.3	0.5-0.7	0.9-1.1	1.5-2.0	2.5-3.8	5.0-6.3	9.0-12	16-25	30-40	50-63	75-100	160-250
Ra μm	0.025	0.05	0.1	0.2	0.4	0.8	1.6	3.2	6.3	12.5	25	50
चिन्ह SYMBOL												

परिवर्तन संख्या ALT. NO.	प्राधिकार AUTHY	वर्णन DESCRIPTION	दिनांकित आद्यक्षर DATED INITIAL

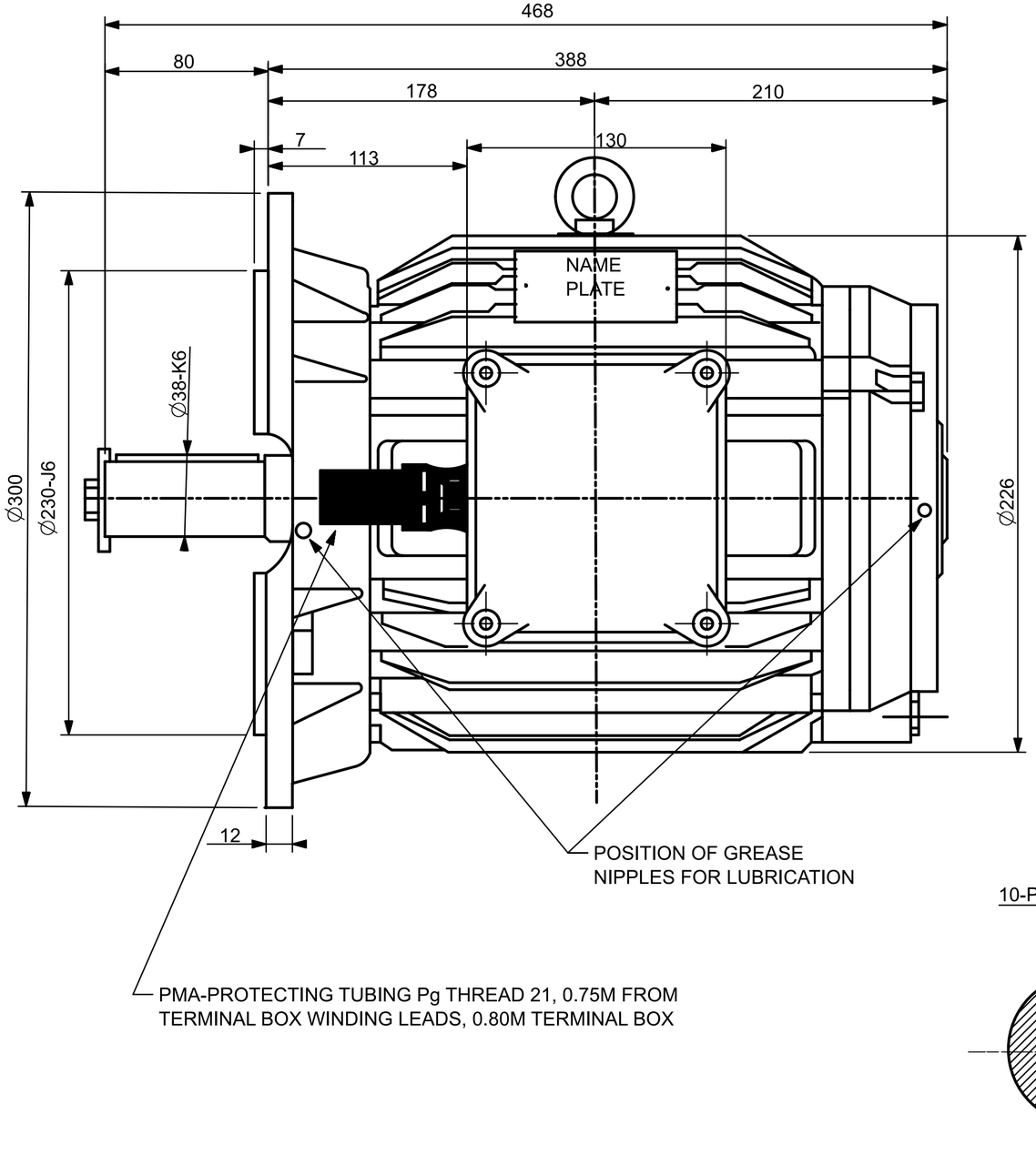
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जाँचा व.अ.अ. CHD SSE	
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अनुमोदित उ.मु.वि.अ. APPROVED DYCEE	
दिनांक DATE	
रेखिक अनुपात SCALE	NTS
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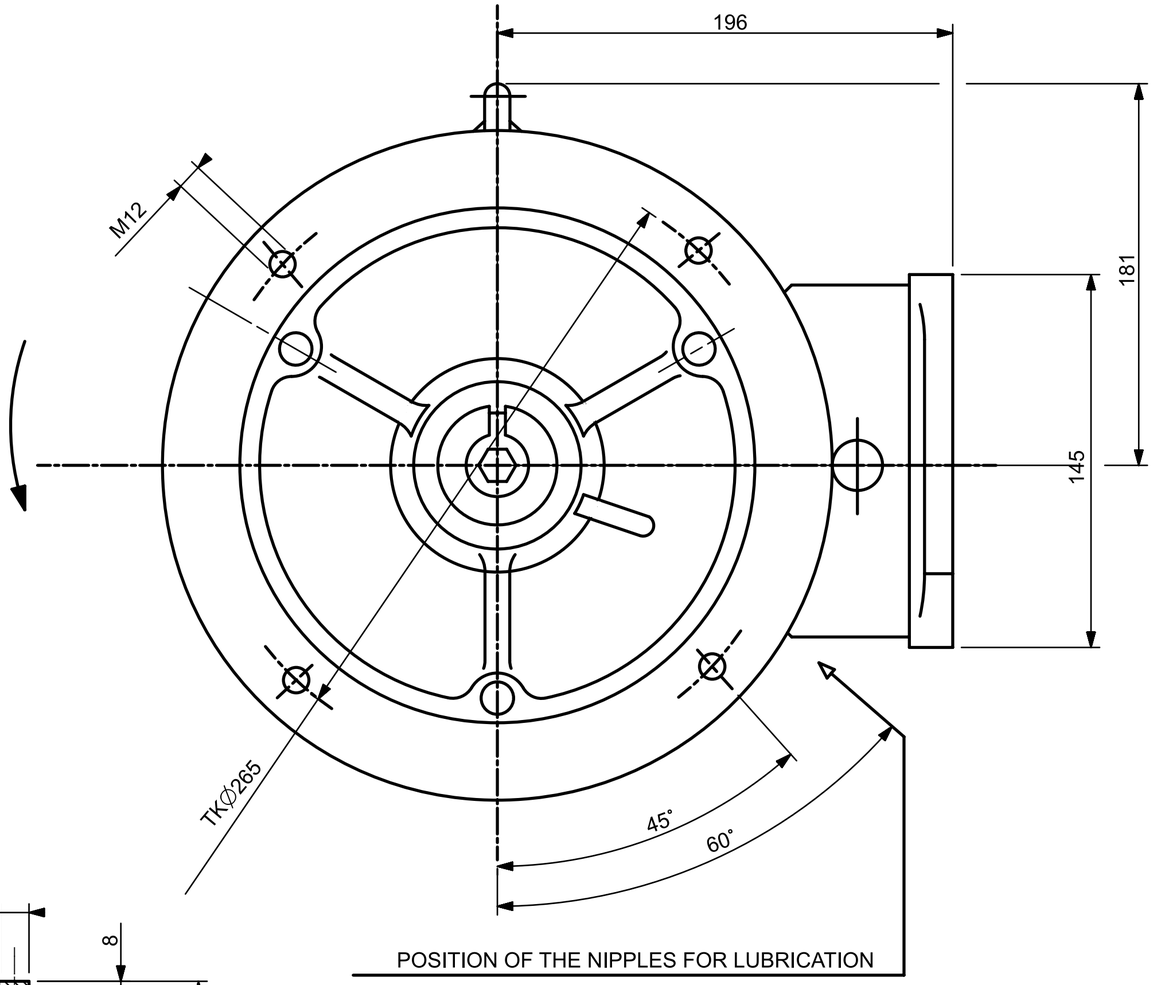
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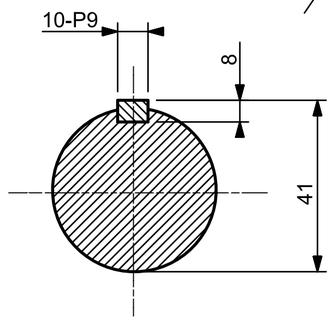
पदार्थ MATL	प्रति भार कि. ग्रा. WT. EACH IN KG
विशिष्टि SPECN	
वर्णन DESCRIPTION	SPECIFICATION FOR MACHINE ROOM BLOWER INCLUDING MOTOR
आरेखण संख्या DRAWING NO.	CLW/ES/3/SK-2/0020/1
परिवर्तन संख्या ALTERATION NO.	पर्ण SHEET 1 OF 1 — A2

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धातु–वेल्डन चिन्ह भा. मा. : 813 / अ. मा. सं. :2553 WELDING SYMBOLS TO IS:813 / ISO:2553	अनिर्दिष्ट सद्य – सीमा भा. मा. : 2102 / अ. मा. सं. : 2768 UNSPECIFIED TOLEARANCE TO IS : 2102 / ISO : 2768											TOL. CLS.	
सतह – रुक्षता का मान भा. मा. 3073 / अ. मा. सं. 1302 SURFACE ROUGHNESS VALUE TO IS:3073 / ISO:1302	पदांक GRADE NO.	सं1 N1	सं2 N2	सं3 N3	सं4 N4	सं5 N5	सं6 N6	सं7 N7	सं8 N8	सं9 N9	सं10 N10	सं11 N11	सं12 N12
	Rz	0.16-0.3	0.5-0.7	0.9-1.1	1.5-2.0	2.5-3.8	5.0-6.3	9.0-12	16-25	30-40	50-63	75-100	160-250
	Ra μm	0.025	0.05	0.1	0.2	0.4	0.8	1.6	3.2	6.3	12.5	25	50
	चिन्ह SYMBOL												

परिवर्तन संख्या ALT. NO.	प्राधिकार AUTHY	वर्णन DESCRIPTION	दिनांकित आद्याक्षर DATED INITIAL

निर्देश संख्या REF. NO.	लागत एवं वितरण संख्या C&D NO.	अंग आरेखण संख्या PART DRG. NO.	वर्णन DESCRIPTION	मात्रा QTY.	पदार्थ MATL	विशिष्टि SPECN	प्रति भार कि. ग्रा. WT. EACH IN K.G.

अनिकल्पित DGN	
जाँचा व.अ.अ. CHD SSE	
समीक्षित च.वि.अ. / व.वि.अ. REVIEWED AEE / SEE	
अनुमोदित उ.मु.वि.अ. APPROVED DYCEE	
दिनांक DATE	
रैखिक अनुपात SCALE	NTS
संदर्भ / REF.	ALT.-

चित्तरंजन रेलइंजन कारखाना
CHITTARANJAN LOCOMOTIVE WORKS, INDIA

पदार्थ MATL	प्रति भार कि. ग्रा. WT. EACH IN KG
विशिष्टि SPECN	

वर्णन DESCRIPTION: SPECIFICATION FOR MACHINE ROOM BLOWER MOTOR (3KW,132M FRAME SIZE)

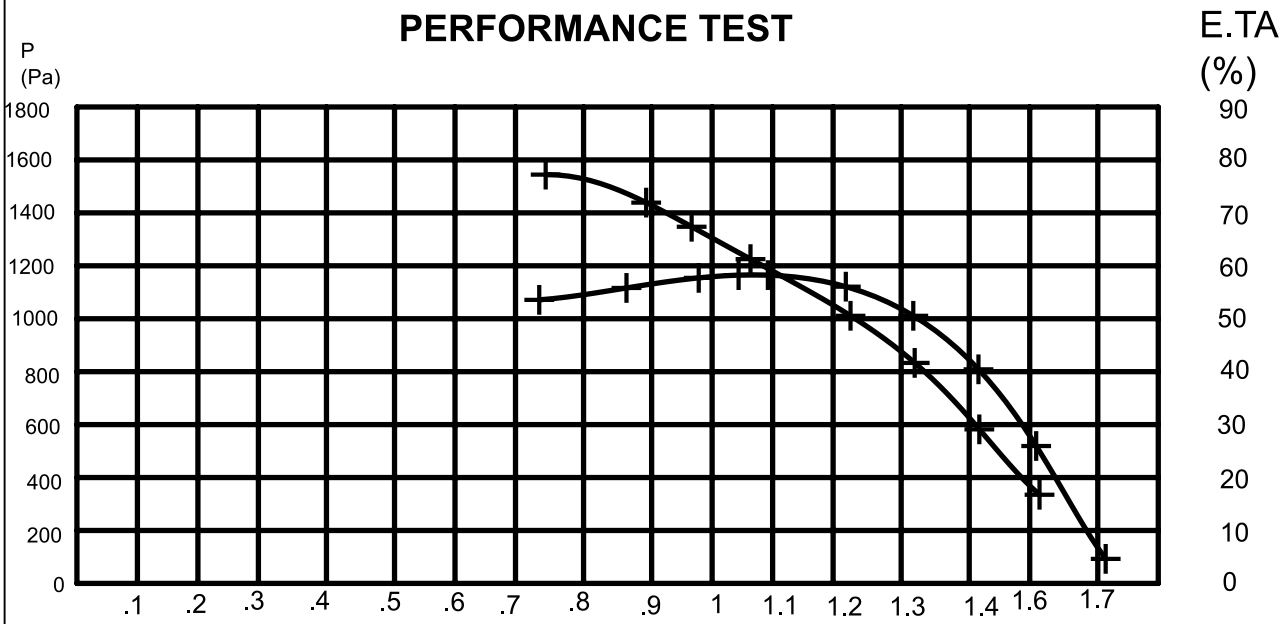
आरेखण संख्या DRAWING NO.: CLW/ES/3/SK-3/0020/I

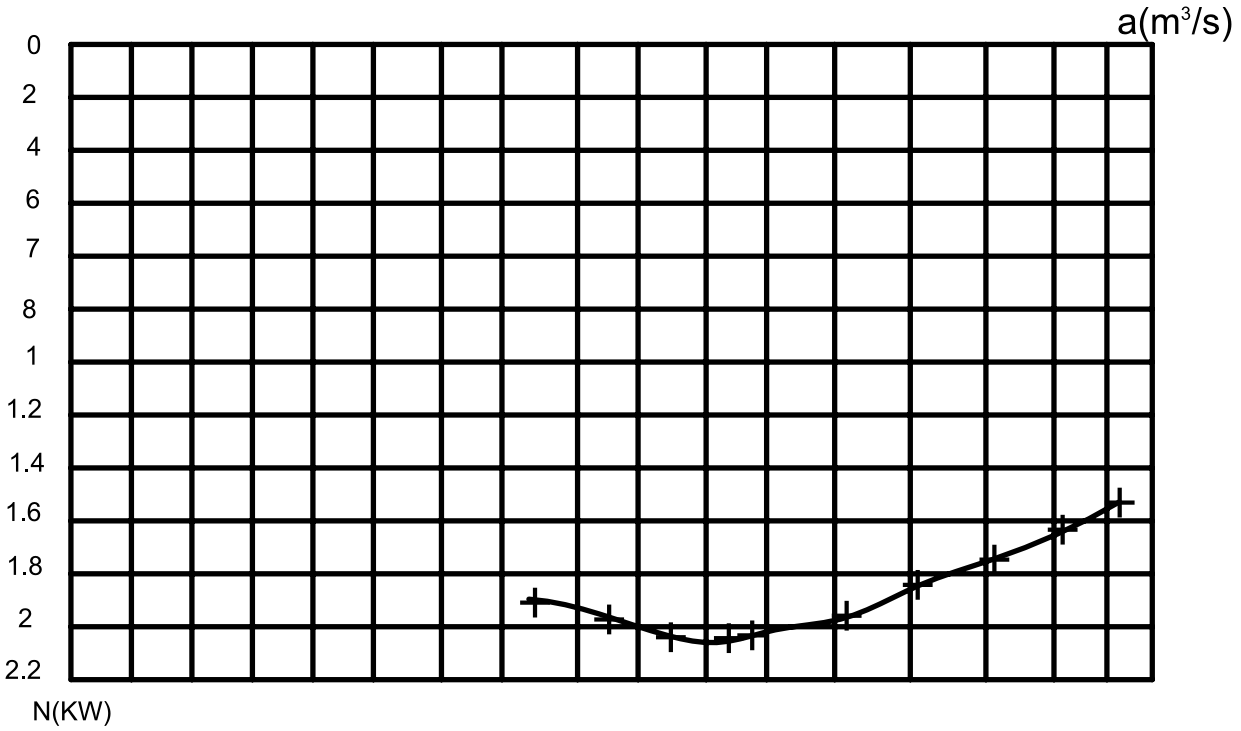
परिवर्तन संख्या ALTERATION NO.	पर्ण SHEET 1 OF 1	A2

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PERFORMANCE TEST





परिवर्तन संख्या ALT.NO.	प्राधिकार AUTHY	वर्णन DESCRIPTION	दिनांकित बाद्यक्षर DATED INITIAL

सतह – रुक्षता का मान भा. मा. 3073 / अ. मा. सं. 1302 SURFACE ROUGHNESS VALUE TO IS:3073 / ISO:1302	अनिर्दिष्ट सह्य – सीमा भा. मा. : 2102 / अ. मा. सं. : 2768 UNSPECIFIED TOLEARANCE TO IS : 2102 / ISO : 2768	TOL. CLS.
	धातु–वेल्डन चिन्ह भा. मा. : 813 / अ. मा. सं. :2553 WELDING SYMBOLS TO IS:813 / ISO:2553	

पदांक GRADE NO.	सं1 N1	सं2 N2	सं3 N3	सं4 N4	सं5 N5	सं6 N6	सं7 N7	सं8 N8	सं9 N9	सं10 N10	सं11 N11	सं12 N12
Rz	0.16-0.3	0.5-0.7	0.9-1.1	1.5-2.0	2.5-3.8	5.0-6.3	9.0-12	16-25	30-40	50-63	75-100	160-250
Ra μm	0.025	0.05	0.1	0.2	0.4	0.8	1.6	3.2	6.3	12.5	25	50
चिन्ह SYMBOL												

अभिकल्पित DGN	
जाँचा व.अ.अ. CHD SSE	
सभीक्षित स.वि.अ. / व.वि.अ. REVIEWED AEE / SEE	
अनुमोदित उ.मु.वि.अ. APPROVED DYCEE	
दिनांक DATE	
रैखिक अनुपात SCALE	NTS
संदर्भ / REF.	ALT.-

चित्तरंजन रेलइंजन कारखाना
CHITTARANJAN LOCOMOTIVE WORKS, INDIA

पदार्थ MATL	प्रति भार कि. ग्रा. WT. EACH IN KG
विशिष्टि SPECN	

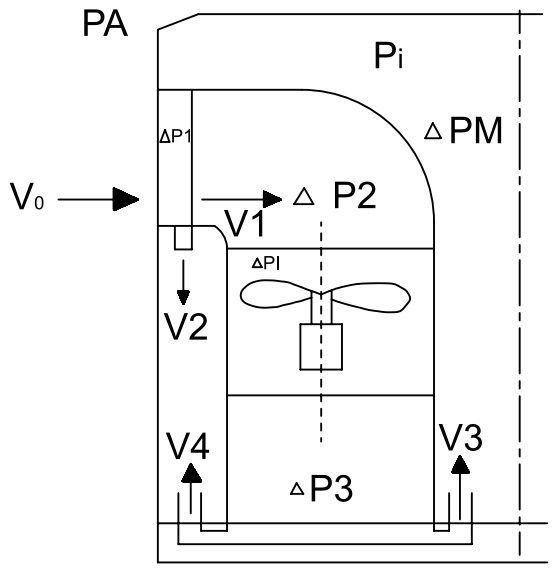
वर्णन DESCRIPTION **SPECIFICATION FOR MACHINE ROOM BLOWER INCLUDING MOTOR**

आरेखण संख्या DRAWING NO. **CLW/ES/3/SK-4/0020/ I**

परिवर्तन संख्या ALTERATION. NO. | पर्ण SHEET 1 OF 1 | A4

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$$V_0 = V_1 + V_2$$

$$V1 = \sum_{j=3}^{n} Vj$$

n= Number of cubicles
electronics to be cooled

$$\triangle PM = Pi - PA$$

$$\triangle PL = \sum_{i=1}^{3} \triangle Pi + \triangle PM + Max(\triangle Pj)$$

परिवर्तन संख्या ALT.NO.	प्राधिकार AUTHY	वर्णन DESCRIPTION	दिनांकित बाद्यक्षर DATED INITIAL

सतह – रुक्षता का मान भा. मा. 3073 / अ. मा. सं. 1302 SURFACE ROUGHNESS VALUE TO IS:3073 / ISO:1302	अनिर्दिष्ट सह्य – सीमा भा. मा. : 2102 / अ. मा. सं. : 2768 UNSPECIFIED TOLEARANCE TO IS : 2102 / ISO : 2768	TOL. CLS.
	धातु–वेल्डन चिन्ह भा. मा. : 813 / अ. मा. सं. :2553 WELDING SYMBOLS TO IS:813 / ISO:2553	

पदांक GRADE NO.	सं1 N1	सं2 N2	सं3 N3	सं4 N4	सं5 N5	सं6 N6	सं7 N7	सं8 N8	सं9 N9	सं10 N10	सं11 N11	सं12 N12
Rz	0.16-0.3	0.5-0.7	0.9-1.1	1.5-2.0	2.5-3.8	5.0-6.3	9.0-12	16-25	30-40	50-63	75-100	160-250
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चिन्ह SYMBOL												

अभिकल्पित DGN	
जाँचा व.अ.अ. CHD SSE	
सभीक्षित स.वि.अ. / व.वि.अ. REVIEWED AEE / SEE	
अनुमोदित उ.मु.वि.अ. APPROVED DYCEE	
दिनांक DATE	
रैखिक अनुपात SCALE	NTS
संदर्भ / REF. ALT.-	

चित्तरंजन रेलइंजन कारखाना
CHITTARANJAN LOCOMOTIVE WORKS, INDIA

पदार्थ MATL	प्रति भार कि. ग्रा. WT. EACH IN KG
विशिष्टि SPECN	

वर्णन DESCRIPTION: SPECIFICATION FOR MACHINE ROOM BLOWER INCLUDING MOTOR

आरेखण संख्या DRAWING NO.: CLW/ES/3/SK-5/0020/ I

परिवर्तन संख्या ALTERATION. NO. | पर्ण SHEET 1 OF 1 | A4

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