ENCLOSURES: DRG. NOS.

Drg. No.
(i) CLW/ES/3/SK-1/0019/G
(ii) CLW/ES/3/SK-2/0019/G
(iii) CLW/ES/3/SK-3/0019/G
(iv) CLW/ES/3/SK-4/0019/G
(v) CLW/ES/3/SK-5/0019/G
(vi) CLW/ES/3/SK-6/0019 /G

(vii) Specification Nos.:-
(a) CLW/ES/3/0454/A (for motor – 39 sheets)
(b) CLW/ES/3/0455 (for blower – 16 sheets)

SPECIFICATION FOR TRACTION MOTOR BLOWER INCLUDING MOTOR FOR 3-PHASE ELECTRIC LOCOMOTIVES OF INDIAN RAILWAY

SPECIFICATION NO.:- CLW/ES/3/0019 ALT. G

ISSUE DATE: 05.07.2001

ISSUED BY:
DY. CHIEF ELECTRICAL ENGINEER/D-II
CHITTARANJAN LOCOMOTIVE WORKS
P.O. CHITTARANJAN – 713331
DIST. BARDHAMAN (WEST), WEST BENGAL (INDIA)

PREPARED BY	CHECKED BY	APPROVED BY
JE/SSE(DESIGN)	AEE/SEE(DESIGN)	DY. CEE/D-II

ALTERATION RECORD SHEET

Amendment No.	Date of Amendment	Page No.	Alteration	Reason	Authority
1.	26.2.97	4,5	A	Ambient Temp., Technical Data of Blower, Air delivery, Motor Speed, Insulation, Temp. rise, degree of protection, rating etc. added at page no. 4 & 5.	
2.	22.3.01	8	B	Details of drilled holes & fixing of inlet flange & cone shown at sheet no. 8.	
3.	11.5.01		C	The Specn. has been revised completely and details of Test procedure has been deleted and Ref. has been made to CLW/ES/3/0454 and CLW/ES/3/0455 which gives the details of testing procedure as per RDSO's instructions. Dimensions of Duct assly. (sh. 9) has been corrected.	
4.	11/12/2002	8	D	Note :- 6) added at sheet no. 8.	
5.	14/02/2003	7, 8	E	(i) Note :- 7) & 8) added at sheet no. 8 as per RDSO letter no.:- EL/3.2.176/2 dt. 3/2/2003. (ii) Note :- 2) added at sheet no. 7.	
6.	29/03/2003	8	F	One rain water drain pipe provided on blower housing at sheet no. 8 & Note (9) added.	
7.	20/10/05		G	Note : added at sheet no- 5. & "note that motor is foot mounted horizontally" at sheet-8.	21/10/05
8.	11.10.19	8	H	Rain water drain pipe is 10mm (Max) (O/D) instead of 6mm (O/D) as per RDSO MS no. ELRS/MS/0328 (Rev 0) vide letter no. EL/32.176/2 dt 29.10.03	
9	7.	I		warranty clause Added.	

SPECIFICATION FOR SCAVENGE BLOWER FOR TRACTION MOTOR	DRN. SSE	CHKD/REV SEE/D&D	D & D CENTRE CHITTARANJAN LOCOMOTIVE WORKS WEST BENGAL, INDIA
	APPROVED BY 13/5/01 DY.CEE/CON/TU-I		DATE:11-05-2001 NO: CLW/ES/3/0021
			ALT A B C D E F G

INDEX

SL. NO	DESCRIPTION	SHEET NO
1	SCOPE	4
2	CLIMATIC & INVIRONMENTAL CONDITIONS	4
3	STANDARDS	4-5
4	TECHNICAL DATA	5-7
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8	DRAWINGS	10
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SPECIFICATION FOR TRACTION MOTOR BLOWER INCLUDING MOTOR

1. **SCOPE**

1.1 This specification applies to Traction Motor Blower including Motor for 3-phase Electric locomotive. Quantity per loco – 2 Nos.

1.2 Blower including 3-phase asynchronous motor, supplied by a static converter. The equipment will be suitable for traction application.

2. **CLIMATE AND ENVIRONMENT CONDITIONS: -**

* Maximum Atmospheric Temperature : Under Sun : 70ºC
: In shade : 50 ºC

* Humidity: 100% saturation during rainy season

* Ambient Temp : 0……+55ºC (motor in air flow)
*Humidity normal : 60%
maximum : 100%

*Altitude normal : 160 m above mean sea level
*Cooling : Power dissipation in air flow

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

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 : 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 1231/1991/Dimension of three phase foot mounted induction motors.
IS: 4029/1991/Guide for testing three phase induction motors.
IS:13730 (Pt.8)/1993/specification for polyesterimide enameled round copper winding wires with temperature class 180.

IS 13730 (Pt.13)/specification for dual coated enameled round copper wires with temperature class 200.
IS 11184/1994/Enameled 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: 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 38/1983 : 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.

4. TECHNICAL DATA: -

4.1 Nominal datas:

4.1.1 Traction motor blower

Number of blowers per loco	: 2
V1 Air flow per blower (M^3/sec)	: 4.05 at 20°C
Total air flow (M^3/sec)	: 8.10
Pressure drops (pa)	
Δp1 strata – panel – filter	: 721
Δp2 Air duct filter – blower	: 59
Δp3 Air duct filter – blower	: 432
Δp4 Bellow	: 54
Δp5 Traction Motor	: 1600
Δp6 Air outlet	: 28
- Reserve	: 26
Δp static (pa)	: 2920
Δp dynamic (pa)	: 30
Δp total (pa)	: 2950
Speed	: 2920 r.p.m.
p mech (kw)	: 21.7
Weight of complete unit	: 416 kg. approx.
Traction motor cooling blower type	: Mixed flow centrifugal

4.2 **Nominal Motor data:**

Nominal shaft power25 kw/2pole Flange mounted, Frame size: 200 L
Power consumption: 27.3 kw
Voltage: 3x415 V ± 10%
Current: 42 A
Starting current: 265 A
Frequency: 50 Hz
Cos ø: 0.92
Efficiency: 90%
Class of protection: IP 55
Class of insulation: H class with VPI
Weight of motor: 265 Kg. approx.

4.3 **Temperature rise limit:**

The permitted temperature rise of the motor winding will be: -
= Specified temp-rise of class H insulation minus 65°C
= 145°C-65°C = 80°C
Vacuum pressure impregnation of the stator winding will have to be done.
Type of Enclosure: TESC (Totally enclosed surface cooled)
Type of bearing DE & NDE = 6312 (open type to be used)

Only SKF/FAG (imported) bearing shall be used. NSK JAPAN make of Bearings can also be used.

4.4 **Power supply**

The equipment will be fed by static auxiliary converter and its principle is shown in sketch no. CLW/ES/3/SK-5/0019.

The salient data of auxiliary converter are given as under:

Line voltage : nominal Un = 1000V
Un, max = 1200V
Line Frequency : f = 50 Hz ±5%

4.4.1 **Supply voltage to motor:**

The asynchronous motor will be supplied with the output of an inverter having a pulse width modulated output voltage as under:
Voltage nominal Uv, eff, nom: 415 V±10% (fundamental wave)
Variation Uv, eff: 104….420V (fundamental wave)
Frequency nominal f nom : 50 Hz (fundamental wave)
Variation f: 12.5….50 Hz (fundamental wave)
Switching frequency Hz : max. 300
Harmonics in current : 50%
Slop du/dt : V/us: <1000 v/micro second

Voltage spikes V AC : <1000 (peak value)
Type of power circuit : two level
Harmonic in voltage : 50%

4.4.2 Voltage stress between motor terminal and earth for continuous operation:

Middle point earthing of transformer winding with resistors, current relays for earth fault detection.

Us, max = Uic, max /2+On, max. 2=1153 V (peak value)

Earth fault (stress about 1 day within 10 years):

Us, max = U ic, max /2+On, max. 2=2002 V (peak value)

4.4.3 Control of Auxiliary Converter:

For static operation, the converter will be controlled with full inputs or fundamental frequency method. The intermediate circuit voltages will be controlled proportional to the output frequency. For transient operation, the converter will be controlled with subharmonic method.

4.4.4 Wave from output of converter:
The output wave form has been shown in sketch No.CLW/ES/3/SK-5/0019/G.

Nominal voltage Uveff : 415 V ± 10% (Quasi-square wave)
Voltage Variation Uveff : 94 -420 V (fundamental wave)
Nominal frequency : 50Hz
Frequency variation : Varies in three steps: 24 Hz, 37 Hz, 50Hz
Intermediate circuit voltage Uic : 120-580 V
Slope du/dt : 100-580 V

5. **TYPE TEST AND ROUTINE TESTS: -**
Tests are classified as type test and routine tests.

TESTS ON MOTORS:-

A) **Type tests:** - (To be conducted on Prototype Motors): Refer Specification No. CLW/ES/3/0454

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"
Starting current at 307V
Running current at 307V

B) **Routine Tests: -**
Resistance Measurement
Direction of Rotation
No Load Test
Locket Rotor Test
Temperature Rise Test
High Voltage Test
Vibration Test
Surge Test
For Details of type test and routine test of motor please refer Specification No. CLW/ES/3/0454.

TESTS ON BLOWER: - (Refer Specification No.CLW/ES/3/0455)

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 at 307V and running current at 307 V to be recorded at 17 Hz.

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 - 15 microns max.
Blower – 40 microns max.

6. OPERATING CONDITION AND RELIABILITY

6.1 Operating time

Daily approx.	: 16 hrs. (approx. 330 days per year)
Yearly approx.	: 5600 hrs.
Within 30 years approx.	: 16800 hrs.
Current maintenance	: 30 years

6.2 **Reliability:**

According to chapter "environmental condition" the MTBF of 1 motor shall be at least 20,000 hrs. The lifetime of bearings shall be at least 20,000 hrs.

6.3 Design, construction, installation/dismantling procedure:

Following features are to be taken care while designing the blower:

a) Drive & coupling
b) Direction of rotation
c) Balancing
d) Lifting arrangement
e) Special constructional features

6.3.1 a) Direct driven centrifugal fan with impeller with backward curved blades.
b) Axial casing with guide vanes. Impeller mounted directly on motor shaft.
c) All welded design, hot dip galvanized.

6.3.2 Installation:

i) The fans are intended for vertical installation with the motors downward.
ii) The installation must be carried out in such a way that stresses in the casing is avoided.
iii) The electrical connection is shown on the above-mentioned assembly drawings.

6.3.3 Dismounting:

i) The impeller can be removed without removing the motor.
ii) Dismount the inlet cone, item 2m 2, (see assembly drawing)

7. NAME PLATE

i) Manufacturer's name, type & serial number
ii) Air delivery
iii) Power consumption in KW
iv) Impeller diameter
v) Rated speed
vi) Weight
vii) Manufacturing date & year
viii) Arrow for direction of rotations and direction of airflow to be provided

8. **DRAWINGS**

Drawing nos.: From CLW/ES/3/SK-1/0019/G to CLW/ES/3/SK-6/0019/G. Total 06 nos.

9. **SCOPE OF SUPPLY**

FOR DETAILS REFER- DRG. NO. CLW/ES/3/SK-1/0019/G & CLW/ES/3/SK-2/0019/G.

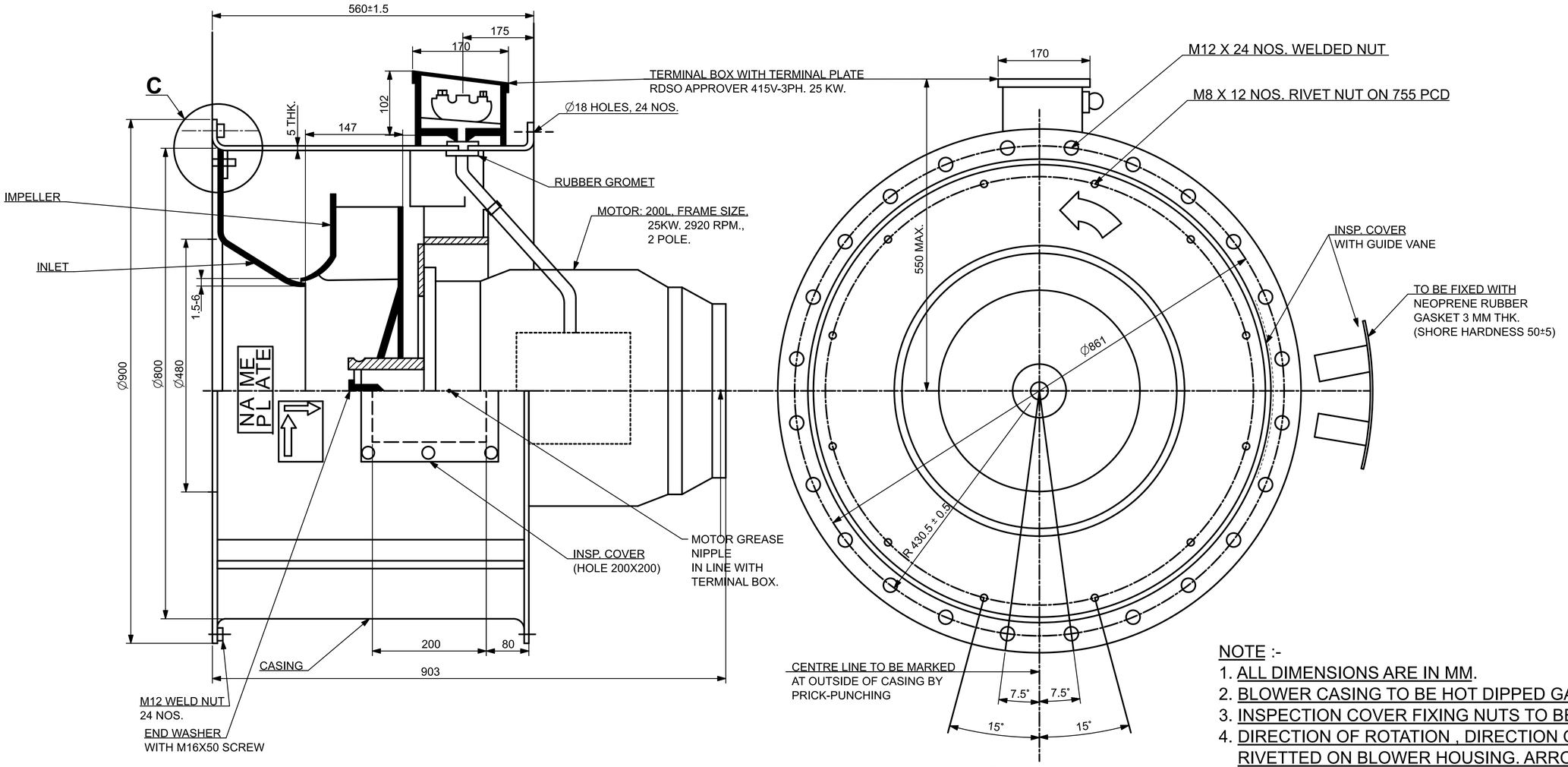
SL. NO.	DESCRIPTION	QTY.
i)	Blower housing	1 No.
ii)	Inlet cone	1 No.
iii)	Impeller	1 No.
iv)	Motor 25 Kw, 2 pole, SQ. 3 phase, 415±10% Volt, TESE, "H" Class Insulation, Flange mounted, Frame size : 200 L	1 No.
v)	Flexible conduit from motor to plug & socket	1 No.
vi)	Wiring cables – Red, Yellow, Blue & Earth, From motor terminal box to terminal box on casing duly crimped with cable lug & connected with heat shrinkage insulating sleeve.	1 set
vii)	Name plate, Direction of rotation & Direction of airflow made of "Al" to be riveted on blower housing.	1 set
viii)	Motor Terminal Box with Terminal Plate on casing. Suitable for 25 Kw 415 V Motor of RDSO approved design.	1 No.

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 hardwares are to be used should be any of the following makes: -
   a) Un-brako (Precision Fasteners)
   b) Laxmi Precision (L.P.S.)
   c) Sundaram Fasteners (T.V.S.)
   d) All spring washers of Forbes Gokak Ltd. make Mumbai only.
3) All non-metallic parts of TM Blower including motor should be fire retardant and self-extinguishing properties as per IS:11731 (Part-I & Part-II) or any other equivalent DIN, IEC standard.

10. WARRANTY : The Supplier must give a clear warranty for a period of six(06) years from the date of supply or Five(05) years from the date of commissioning of the locomotives which ever is earlier.

PREPARED BY	CHECKED BY	APPROVED BY
DEBI PRASAD KONAR Digitally signed by DEBI PRASAD KONAR Date: 2023.04.29 13:19:00 +05'30'	CHANDAN KUMAR Digitally signed by CHANDAN KUMAR Date: 2023.05.02 09:55:58 +05'30'	ANSHU KUMAR VERMA Digitally signed by ANSHU KUMAR VERMA Date: 2023.05.02 13:18:20 +05'30'
JE/SSE(DESIGN)	AEE/SEE(DESIGN)	DY. CEE/D-II



C

NOTE :-

1. ALL DIMENSIONS ARE IN MM.
2. BLOWER CASING TO BE HOT DIPPED GALVANIZED.
3. INSPECTION COVER FIXING NUTS TO BE WELDED ON CASING PROPERLY.
4. DIRECTION OF ROTATION , DIRECTION OF AIR FLOW & NAME PLATE TO BE RIVETTED ON BLOWER HOUSING. ARROWS FOR DIRECTION OF ROTATION & DIRECTION OF AIR FLOW TO BE PAINTED RED.
5. IMPELLER HUB SHOULD HAVE PUNCH MARK INDICATING MAKE & YEAR OF MANUFACTURE.
6. 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

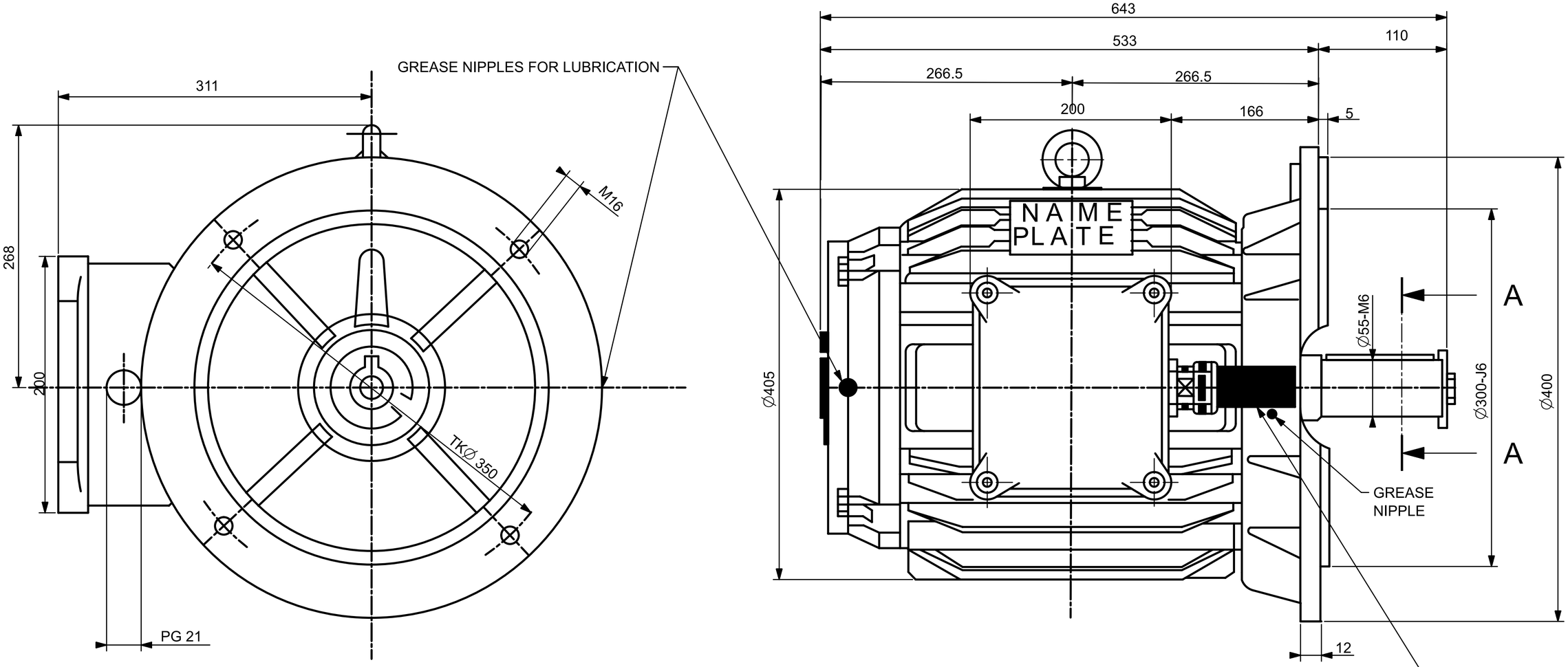
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प्रमाणित प.डि.अ. / व.डि.अ. REVIEWED AEE / SEE	विशिष्टि SPECN
अनुमोदित प.मु.वि.अ. APPROVED DYCEE	वर्णन DESCRIPTION SPECIFICATION FOR TRACTION MOTOR BLOWER INCLUDING MOTOR
दिनांक DATE	पैमाना अनुपात SCALE NTS
	आरेखण संख्या DRAWING NO. CLW/ES/3/SK-1/0019/G
संशोधन / REV. ALT.-	परिवर्तन संख्या ALTERATION NO. / पृष्ठ SHEET 1 OF 1 / A1

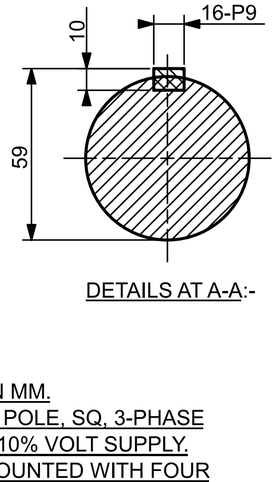
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	ग्रेडांक GRADE NO.	एन1 N1	एन2 N2	एन3 N3	एन4 N4	एन5 N5	एन6 N6	एन7 N7	एन8 N8	एन9 N9	एन10 N10	एन11 N11	एन12 N12
	Rz	816-863	63-67	69-111	15-72	2.5-3.8	5.8-6.3	9.8-17	14-75	36-48	58-63	75-100	160-250
खराद – चकरदा का मान भा. मा. 3073 / अ. मा. सं. 1302 SURFACE ROUGHNESS VALUE TO IS:3073 / ISO:1302	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 हस्ताक्षर DATED INITIAL

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DETAILS AT A-A:-

PMA-PROTECTING TUBING PG THREAD 21, 0.75M FREOM TERMINAL BOX. WINDING LEADS 0.80M FROM TERMINAL BOX.

NOTE:-

1. ALL DIMENSIONS ARE IN MM.
2. MOTOR TYPE :- 25KW, 2 POLE, SQ, 3-PHASE 200L, FRAME SIZE, 415±10% VOLT SUPPLY.
3. VERTICALLY FLANGE MOUNTED WITH FOUR POINT SUPPORT.

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												

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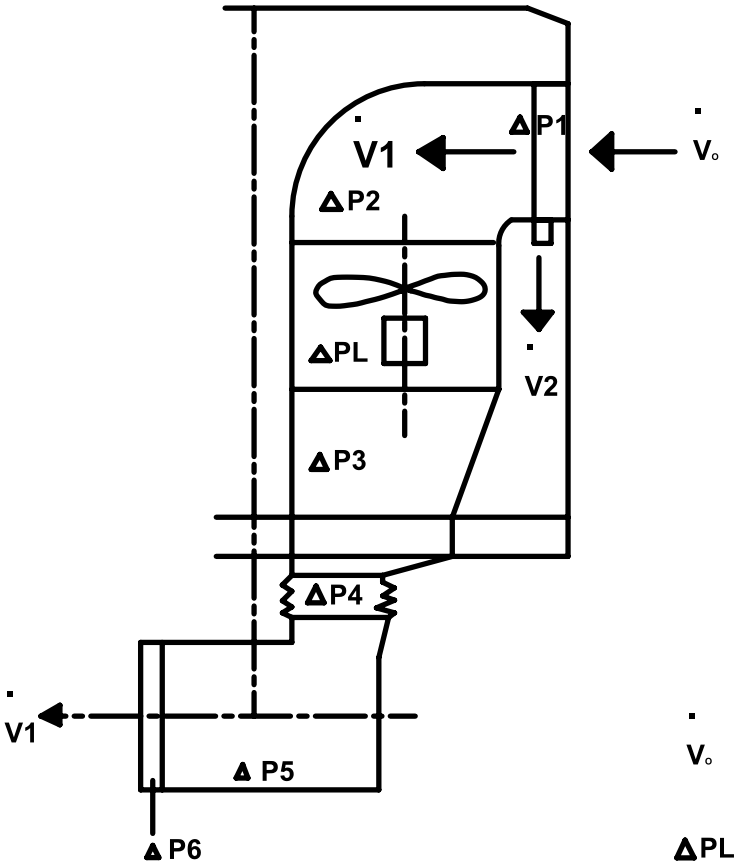
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अनुमोदित उ.मु.वि.अ. APPROVED DYCEE	
दिनांक DATE	
रैखिक अनुपात SCALE	NTS
संदर्भ / REF. ALT.-	

चित्तरंजन रेलइंजन कारखाना
CHITTARANJAN LOCOMOTIVE WORKS, INDIA

पदार्थ MATL	प्रति चार कि. ग्रा. WT. EACH IN KG
विशिष्टि SPECN	
वर्णन DESCRIPTION	SPECIFICATION FOR TRACTION MOTOR BLOWER INCLUDING MOTOR
आरेखण संख्या DRAWING NO.	CLW/ES/3/SK-2/0019/G
परिवर्तन संख्या ALTERATION NO.	पृष्ठ SHEET 1 OF 1
	A2

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$$\dot{V}_0 = \dot{V}1 + \dot{V}2$$

$$\Delta PL = \sum_{i=1}^{6} \Delta P_i$$

परिवर्तन संख्या ALT.NO.	प्राधिकार AUTHY	वर्णन DESCRIPTION	दिनांकित अद्याक्षर 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	
समीक्षित 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	

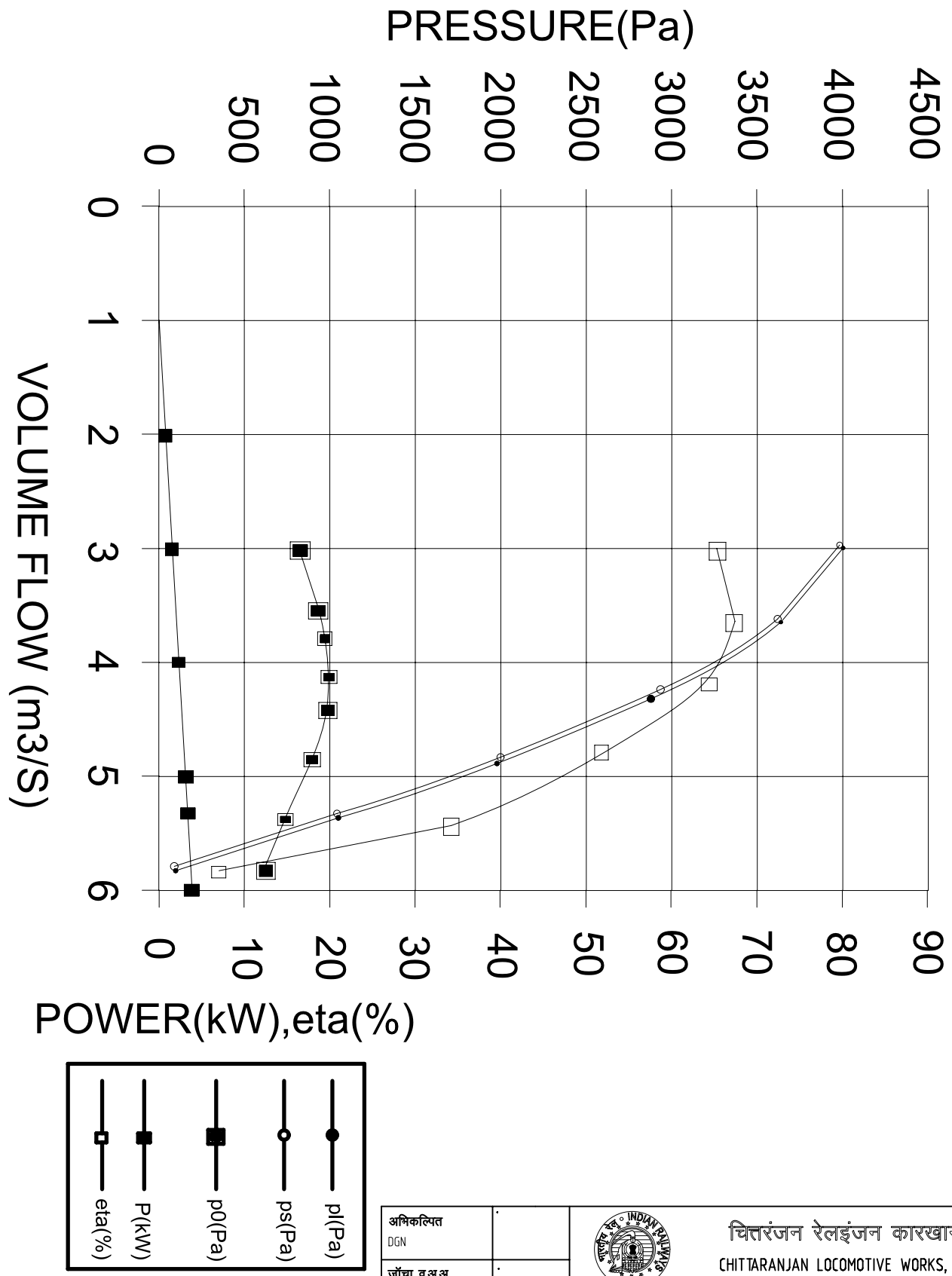
वर्णन DESCRIPTION: SPECIFICATION FOR TRACTION MOTOR BLOWER INCLUDING MOTOR

आरेखण संख्या DRAWING NO.: CLW/ES/3/SK-3/0019/G

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

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परिवर्तन संख्या ALT.NO.	प्राधिकार AUTHY	वर्णन DESCRIPTION	दिनांकित हस्ताक्षर 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: BLOWER CHARACTERISTICS CURVE

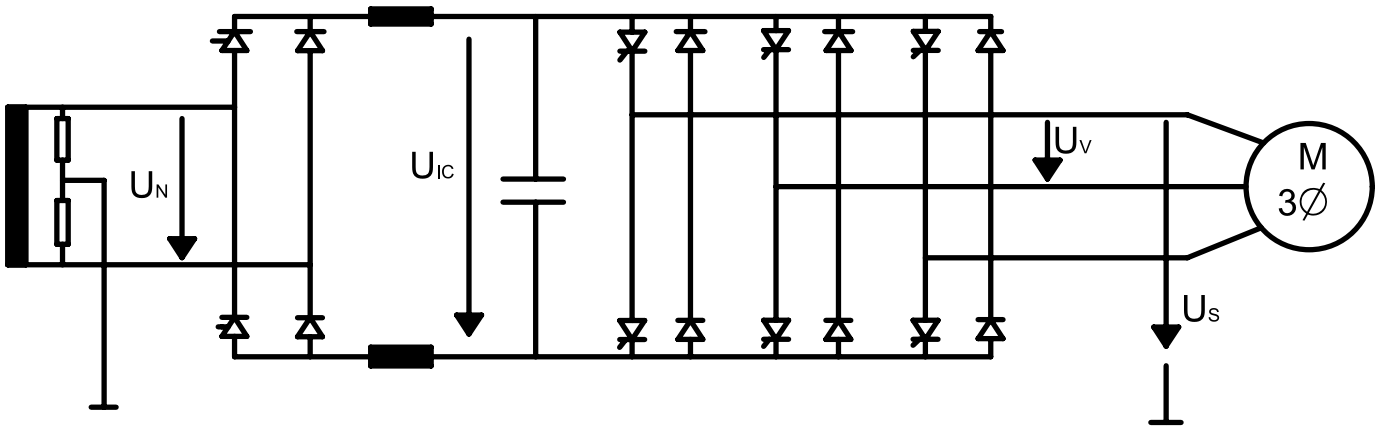
आरेखण संख्या DRAWING NO.: CLW/ES/3/SK-4/0019/G

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

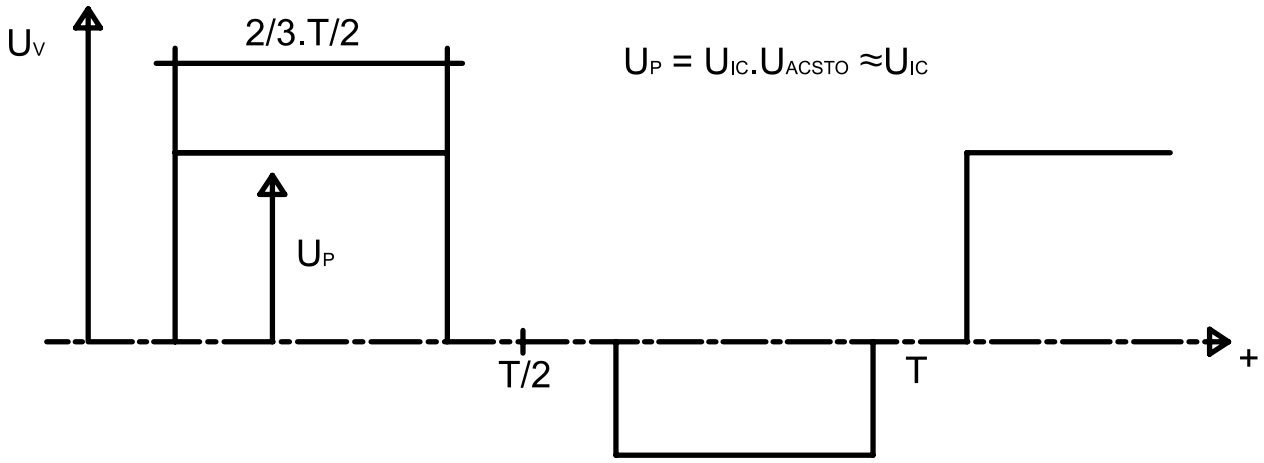
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FIG. SHOWS THE PRINCIPLE OF AN AUXILIARY MACHINE, CONTROLLED BY A STATIC CONVERTER.



WAVEFORM OF OUTPUT



$U_P = U_{IC}.U_{ACSTO} \approx U_{IC}$

NOMINAL VOLTAGE U_{VEFF} : 415V±10%(FUNDAMENTAL WAVE)
VOLTAGE VARIATION U_{VEFF} : 94 - 420V (FUNDAMENTAL WAVE)
NORMAL FREQUENCY : 50±12
FREQUENCY VARIATION : 12.5-50 HZ
INTERMEDIATE CIRCUIT VOLTAGE U_{IC}: 120-580 V
SLOPE du/dt : 100-150 V/µS

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

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

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
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अभिकल्पित DGN	
जाँचा व.अ.अ. CHD SSE	
समीक्षित 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	

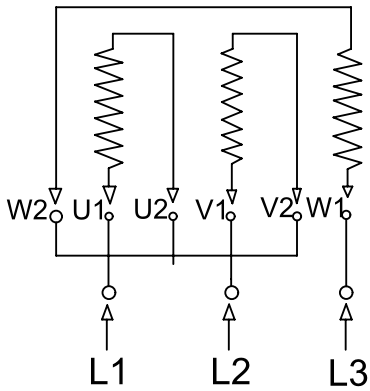
वर्णन DESCRIPTION: SPECIFICATION FOR TRACTION MOTOR BLOWER INCLUDING MOTOR

आरेखण संख्या DRAWING NO.: CLW/ES/3/SK-5/0019/G

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

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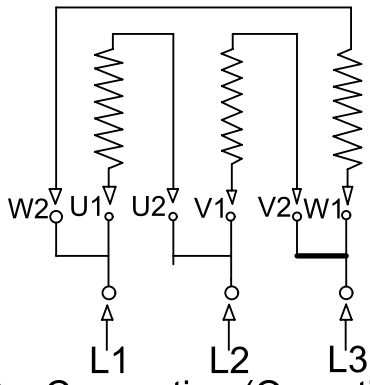
Motor Windings

Windings-ends

Y-△-starting connection

Mains

Y Connection (Start)



Motor Windings

Windings-ends

Y-△-starting connection

Mains

△ - Connection (Operating Position)

CONNECTION -DIAGRAM FOR Y-△-START

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

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

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समीक्षित स.वि.अ. / व.वि.अ. REVIEWED AEE / SEE	
अनुमोदित उ.मु.वि.अ. APPROVED DYCEE	
दिनांक DATE	
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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 TRACTION MOTOR BLOWER INCLUDING MOTOR

आरेखण संख्या DRAWING NO. CLW/ES/3/SK-6/0019/G

परिवर्तन संख्या ALTERATION. NO.

पर्ण SHEET 1 OF 1

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