TECHNICAL SPECIFICATION
FOR TRACTION MOTOR BLOWER INCLUDING MOTOR FOR 3-PHASE ELECTRIC LOCOMOTIVES

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

Enclosure :

(a) **Drawing Nos:**

(i) CLW/ES/3/SK-1/0019/H

(ii) CLW/ES/3/SK-2/0019/H

(iii) CLW/ES/3/SK-3/0019/H

(iv) CLW/ES/3/SK-4/0019/H

(v) CLW/ES/3/SK-5/0019/H

(vi) CLW/ES/3/SK-6/0019/H

(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: 02.07.2001

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ISSUED BY:

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

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ALTERATION RECORD SHEET

Amend No.	Date of amendment	Page No.	Alteration	Reason	Authority
1	01.04.1998	4, 5& 6	A	Ambient temperature changed from 47°C to 55°C, additional point of standard added in clause 3. Additional technical data of motor & blower added at clause no. 4.1.1 & 4.2.	S/D
2	18.09.2000	10	B	Scope of supply and RDSO's instruction for firm's in-house balancing added.	S/D
3	04.07.2001		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	01.03.2002	10 & 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:- 4) added at sheet no. 11.	S/D
6	14.02.2003	10, 11	F	i) Note:- 5) & 6) added at sheet no. 11 as per RDSO L/No. EL/3.2.176/2 dtd. 03.02.2003. ii) Note:- 3) added at sheet no. 10.	S/D
7	22.03.2006	11	G	The hole of blower to fix the duct will be Φ18. The change at sheet no. 11.	S/D
8			I	Warranty Clause added	S/D

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

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INDEX

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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 : -10^{0}C to 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.

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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
V1Air 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

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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)~~ Firm may use sealed bearing, however firm needs to get their drawing approved from RDSO/CLW/BLW, vendors may also suggest any change in BOM to get better quality.

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

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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.

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

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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.

5.1 TESTS ON MOTORS:- 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
- Locket Rotor Test
- Temperature Rise Test
- High Voltage Test
- Vibration Test
- Surge Test
- Visual and Dimensional Check

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5.2 <u>TESTS ON BLOWER: -</u> <u>(Refer Specification No. CLW/ES/3/0455 or latest)</u>

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 - 15 microns max.
Blower – 40 microns max.

6. <u>OPERATING CONDITION AND RELIABILITY :-</u>

6.1 **Operating time**:

Daily approx. : 16 hrs. (approx. 330 days per year)

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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. <u>NAME PLATE</u>:-

i) Manufacturer’s name, type & serial number
ii) Air delivery
iii) Power consumption in KW
iv) Impeller diameter
v) Rated speed

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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 to CLW/ES/3/SK-6/0019. Total 06 nos.

9. SCOPE OF SUPPLY :-

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

SL No.	Description	Qty.
1.	Blower Housing	1 No.
2.	Inlet Cone	1 No.
3.	Impeller	1 No.
4.	Motor 25 KW, 2 pole, SQ. 3 phase, 415±10% Volt, TESE, "H" Class Insulation, Flange mounted, Frame size : 200 L	1 No.
5.	Flexible conduit from motor to plug & socket	1 No.
6.	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
7.	Name plate, Direction of rotation & Direction of airflow made of "Al" to be riveted on blower housing.	1 Set
8.	Motor Terminal Box with Terminal Plate on casing. Suitable for 25 KW 415 V Motor of RDSO approved design	1 No.

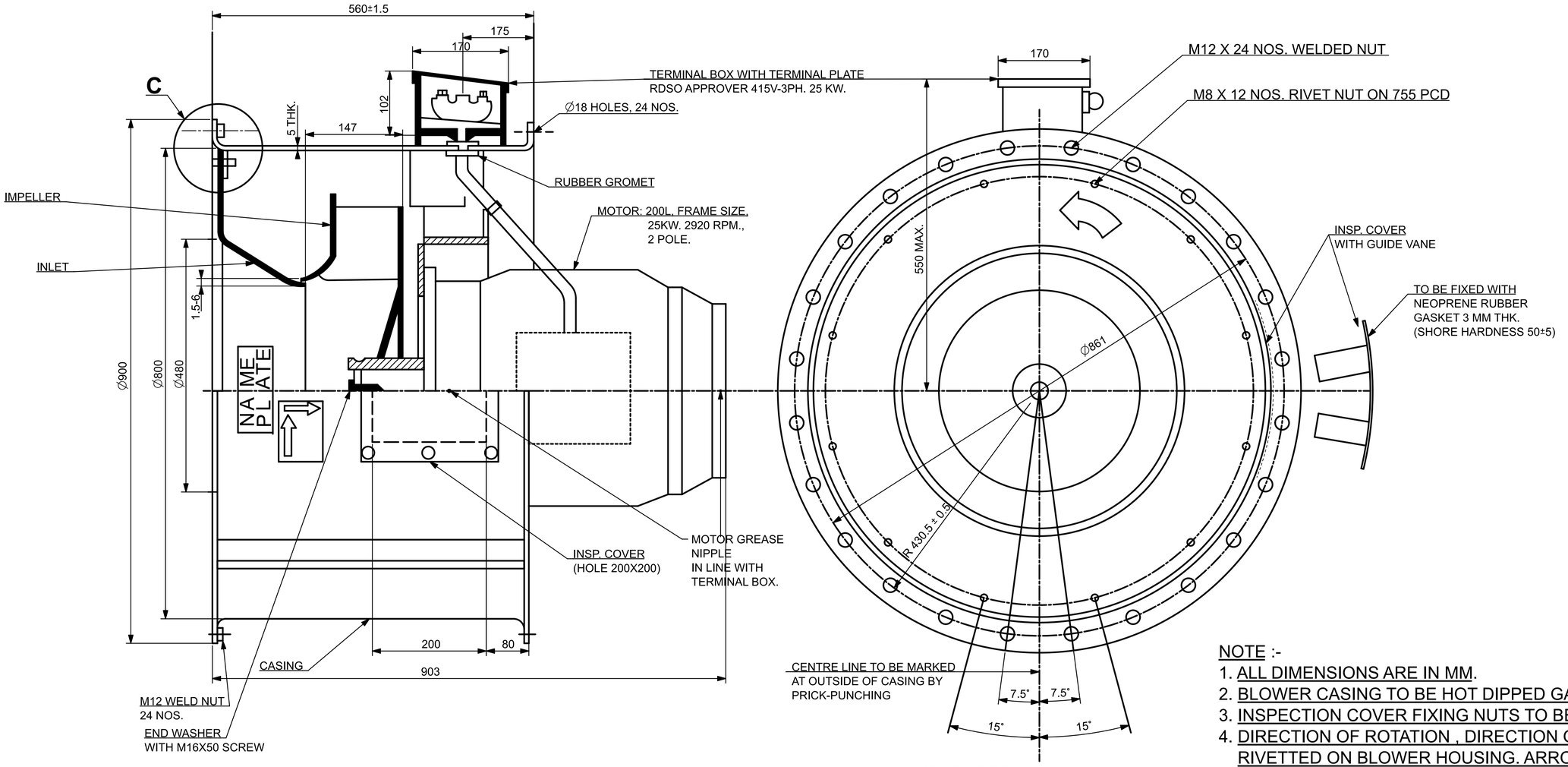
10. WARRANTY :- The supplier must give a clear warranty for a period of 42 month from the date of Supply or 36 Month from the date of commissioning in locomotives whichever is earlier.

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 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.

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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

अभिकल्पित DSN	
जाँचा ह.अ.अ. CHD SSE	
संशोधित प.डि.अ. / ड.डि.अ. REVIEWED AEE / SEE	
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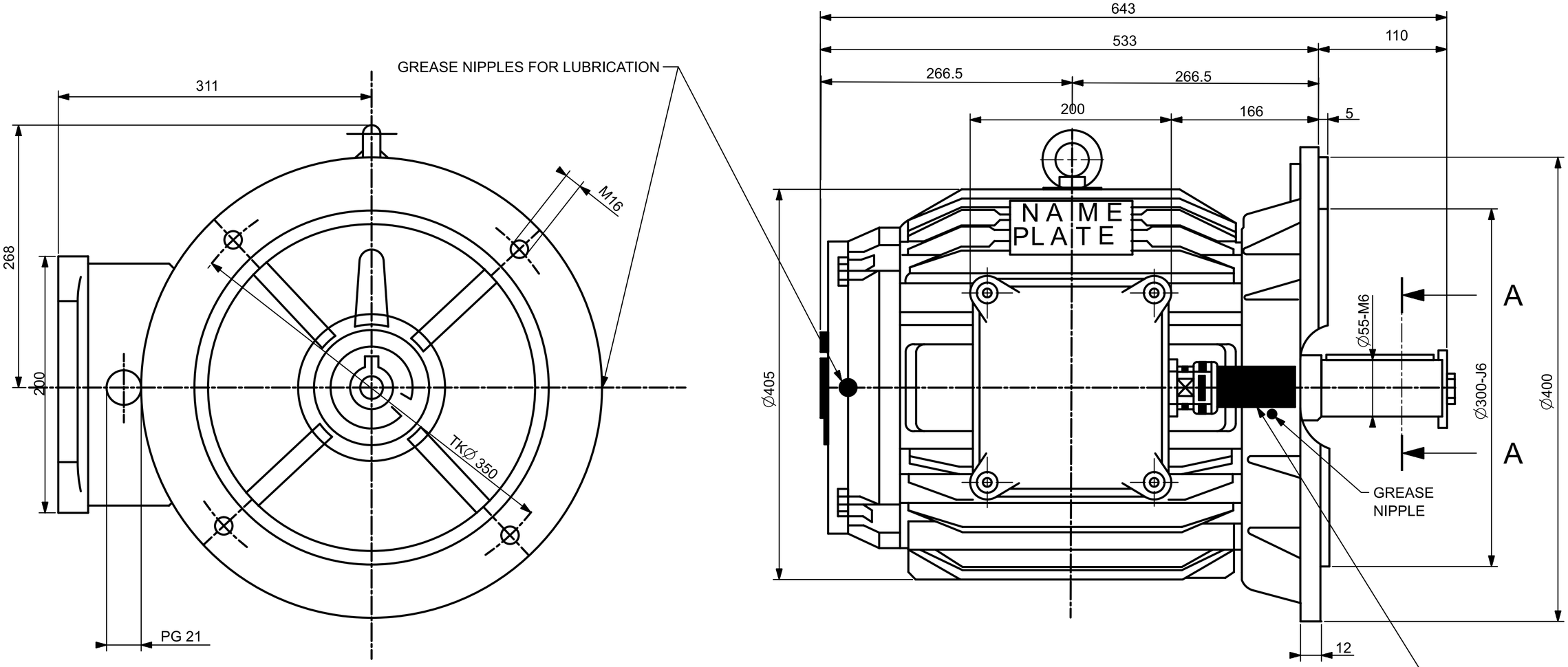
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वर्णन DESCRIPTION	SPECIFICATION FOR TRACTION MOTOR BLOWER INCLUDING MOTOR
आरेखण संख्या DRAWING NO.	CLW/ES/3/SK-1/0019/H
परिवर्तन संख्या ALTERATION NO.	पृष्ठ SHEET 1 OF 1 — A1

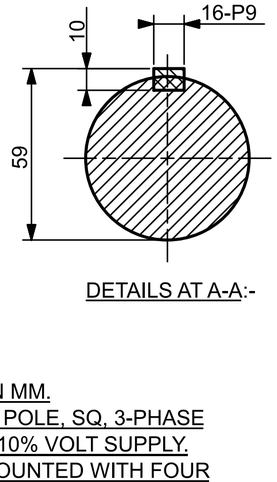
धातु–वेल्डन चिन्ह भा. मा. : 813 / अ. मा. सं. :2553 WELDING SYMBOLS TO IS:813 / ISO:2553	अनिर्दिष्ट सह्यता – सीमा भा. मा. : 2102 / अ. मा. सं. : 2768 UNSPECIFIED TOLERANCE TO IS : 2102 / ISO : 2768												TOL. CLS.
	ग्रेड GRADE NO.	घ1 N1	घ2 N2	घ3 N3	घ4 N4	घ5 N5	घ6 N6	घ7 N7	घ8 N8	घ9 N9	घ10 N10	घ11 N11	घ12 N12
	Rz	8.16-8.3	8.5-8.7	8.9-11	15-7.8	2.5-3.8	5.8-6.3	9.8-12	16-75	35-48	50-63	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 TOLERANCE 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
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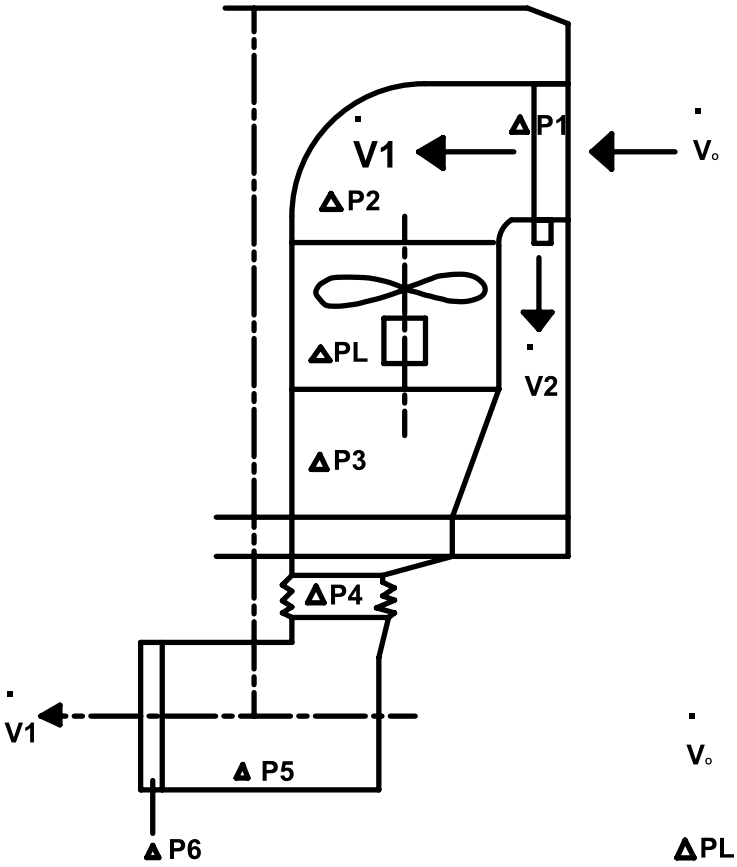
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समीक्षित स.वि.अ. / व.वि.अ. REVIEWED AEE / SEE	
अनुमोदित उ.मु.वि.अ. APPROVED DYCEE	
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रेखिक अनुपात SCALE	NTS
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$$\dot{V}_0 = \dot{V}1 + \dot{V}2$$

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

परिवर्तन संख्या ALT.NO.	प्राधिकार AUTHY	वर्णन DESCRIPTION	दिनांकित आद्यक्षर 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
चिन्ह SYMBOL												

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

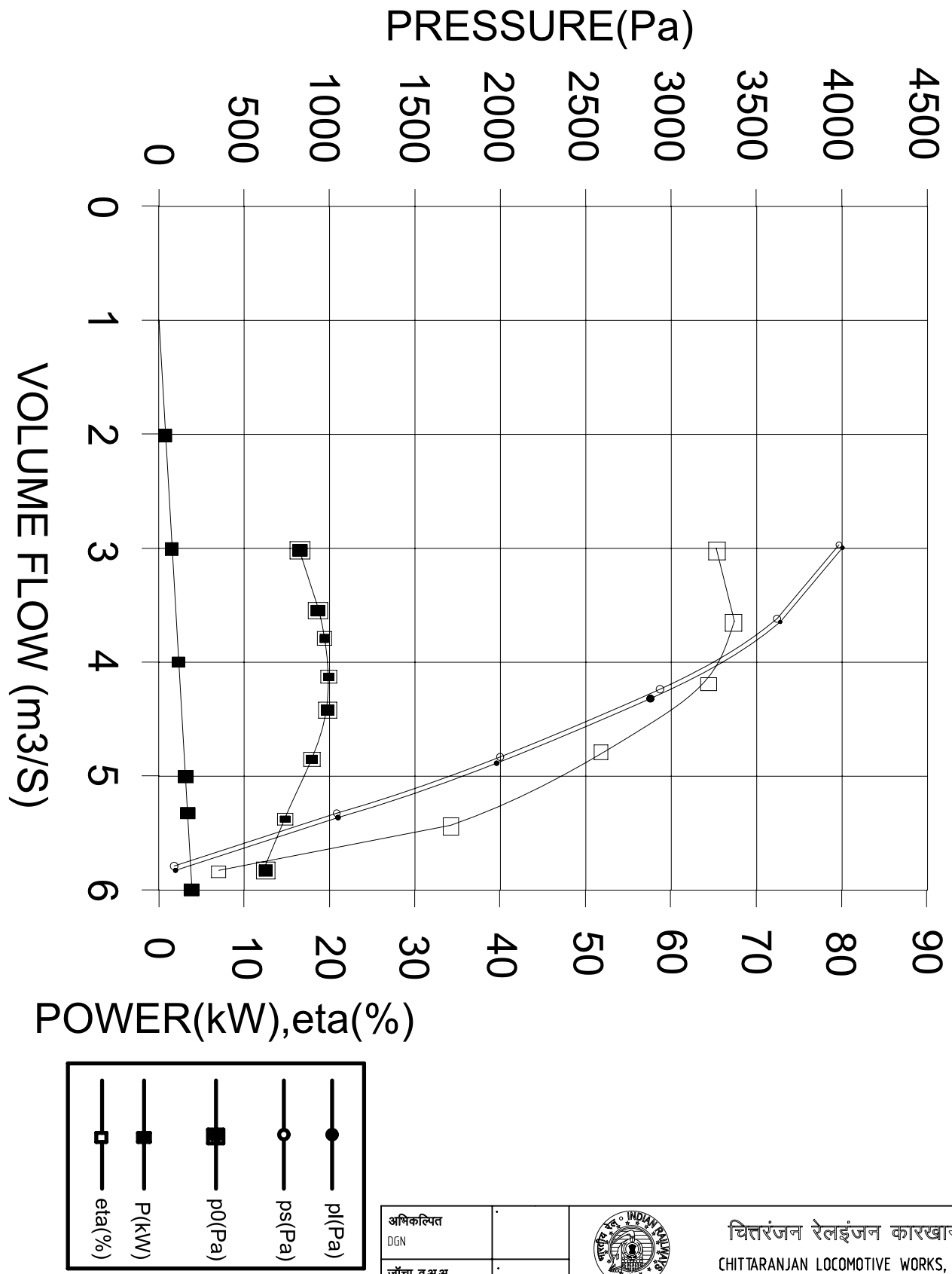
वर्णन DESCRIPTION: SPECIFICATION FOR TRACTION MOTOR BLOWER INCLUDING MOTOR

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

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 सद्य – 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: BLOWER CHARACTERISTICS CURVE

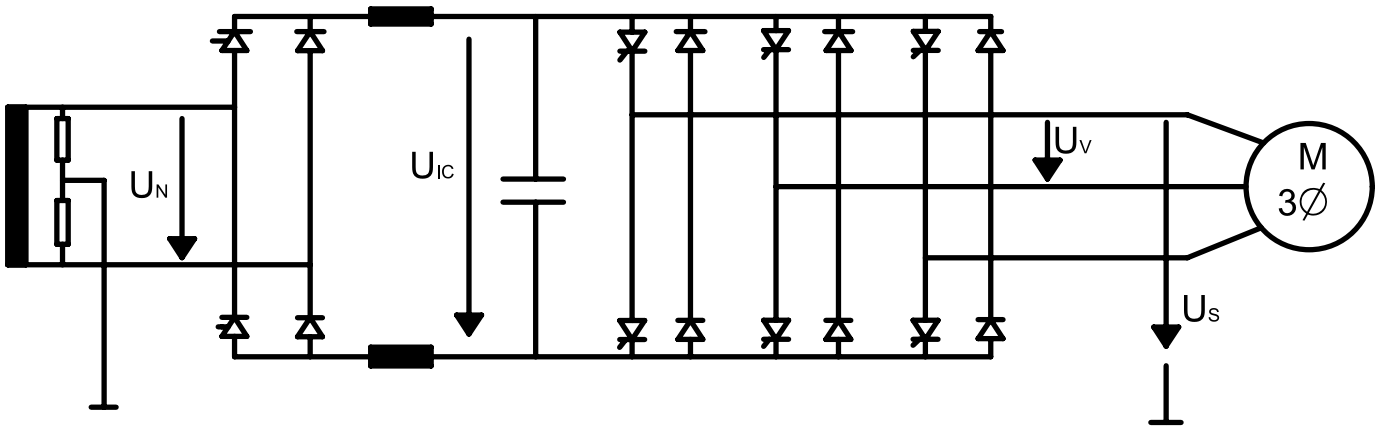
आरेखण संख्या DRAWING NO.: CLW/ES/3/SK-4/0019/H

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

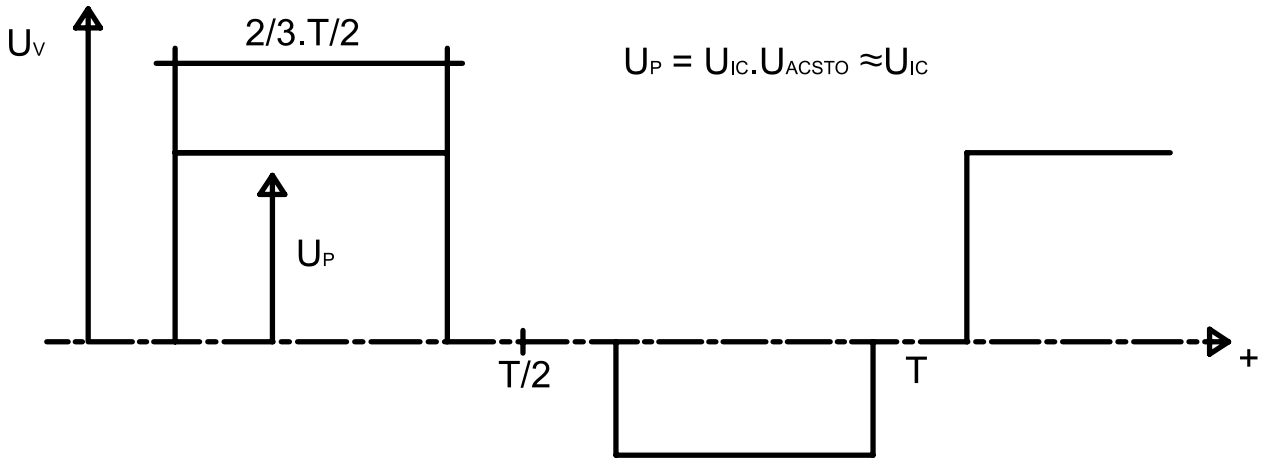
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FIG. SHOWS THE PRINCIPLE OF AN AUXILIARY MACHINE, CONTROLLED BY A STATIC CONVERTER.



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
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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	

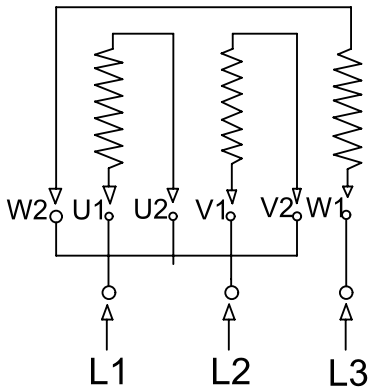
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आरेखण संख्या DRAWING NO.: CLW/ES/3/SK-5/0019/H

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

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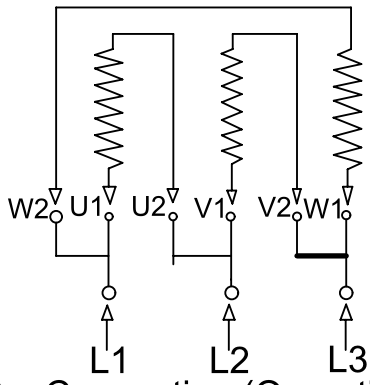
Motor Windings

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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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-6/0019/H

परिवर्तन संख्या ALTERATION. NO.

पर्ण SHEET 1 OF 1

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