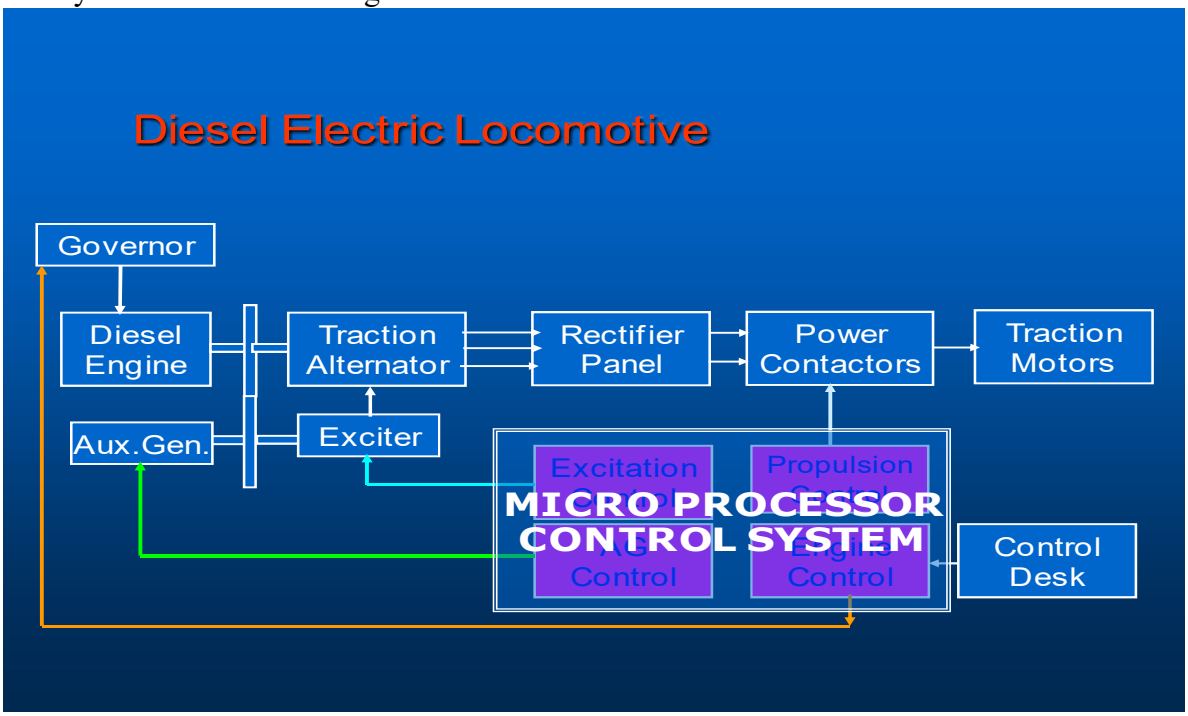
MBCS: Microprocessor Based Control System

The system has the following features



Medha's Microprocessor Based Locomotive Control System MEP 660 overcomes all the limitations of conventional locomotives. It also provides a superior control mechanism, protection to traction equipment, fault diagnostics, and adaptability to different engine types, flexibility in system configuration, etc.

The Microprocessor based Locomotive Control System Type MEP 660 designed and developed by Medha Servo Drives Pvt. Ltd. for Diesel Electric Locomotives takes over the entire locomotive control replacing the conventional E type excitation system, propulsion control, wheel slip control, Voltage regulator, etc.

The Microprocessor based Locomotive Control System MEP 660 continuously monitors the train line signals (MU signals) and controls the excitation of the Alternator based on the operating requests of the Driver. It measures various analog and digital feedback signals from the traction equipment and controls the excitation in such a way to maintain constant Horse Power of the Diesel Engine.

1. The MEP 660 Control System eliminates various general purpose interlocking relays for propulsion control of the conventional system thus reducing the number of interlocks and associated wiring and enhancing the reliability of the locomotive working.
2. The MEP 660 system controls the excitation of the Auxiliary Generator so as to maintain constant output voltage for Battery Charging as well as control circuits in spite of variation in the engine speed from Idle to the 8th notch.
3. The Wheel Slip control in MEP 660 System is based on measuring actual RPMs of all six wheels of the locomotive or Traction Motors depending on the type of sensors installed with the system. With this system, the slip can be identified at the very initial stage itself. Once the wheel slip is identified, it controls the excitation in such a way as to deliver maximum possible tractive effort depending upon the adhesion between the wheel and the rail in the given environmental and track conditions.

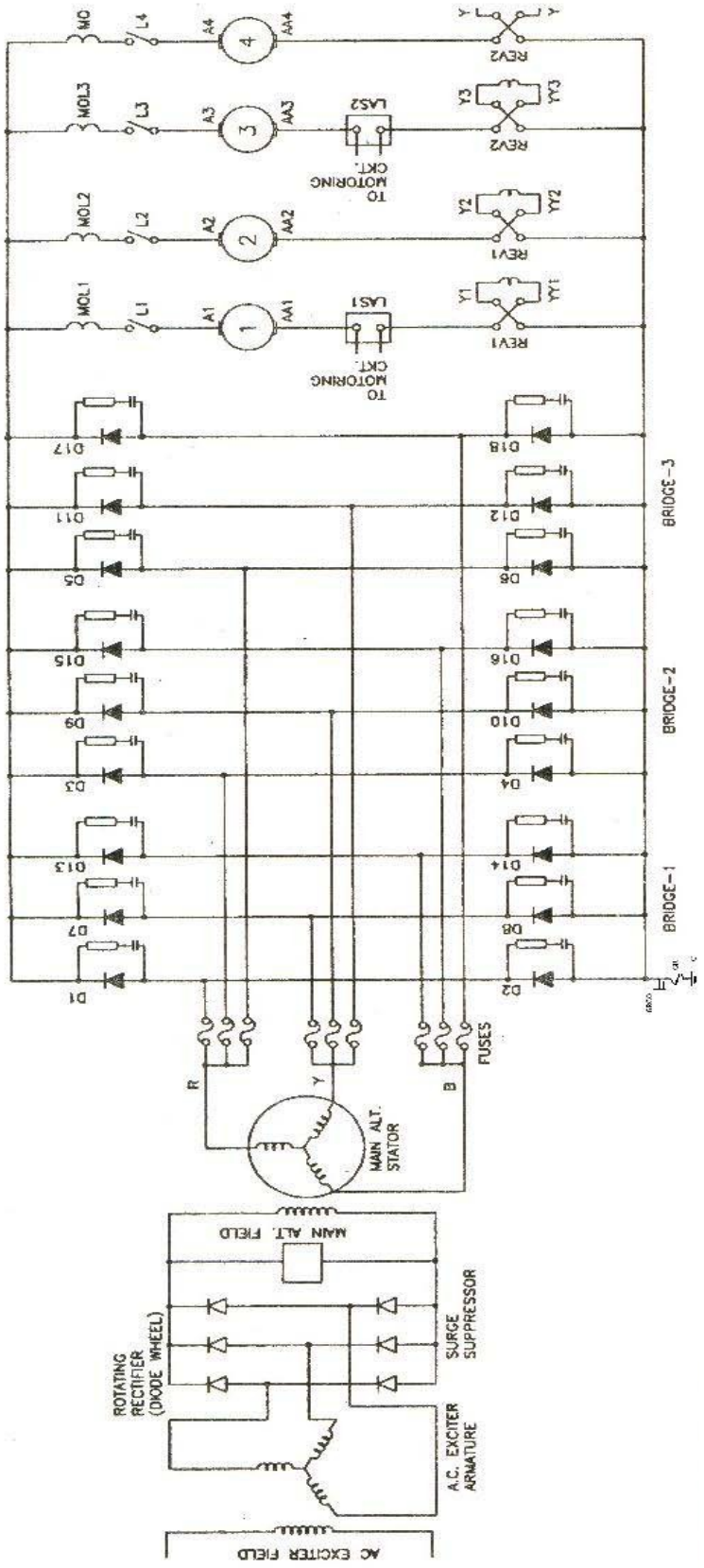
4. The MEP 660 Control System also monitors currents, voltages, temperatures etc of various Traction equipments and controls them in such a way that they always operate within the set specified limits. This enhances the life of the traction equipments and improves the reliability and availability of the locomotive.

Being a Microprocessor based system; the MEP 660 has Fault Diagnostic capabilities.

The System continuously monitors various operational parameters and checks for abnormalities in the functioning of various traction equipments. In case a fault is identified, an appropriate action by way of isolating a sub system or limiting the power, etc is taken to prevent further damage to the equipment and other connected equipments. The fault is also displayed on a Display Unit along with the restrictions imposed because of fault, for the information of the Driver. The fault code along with Real Time and Date stamp is logged in the Error Log Memory. In addition, Ten data packs consisting of various locomotive parameters are recorded from five seconds prior to the declaration of fault to three seconds after the declaration of fault and Fault second & Fault Instant second. For high priority faults 90 seconds data packs consisting of various locomotive parameters are recorded from 59 seconds prior to the declaration of fault to 30 seconds after the declaration of fault and Fault second & Fault Instant second. For a fault 10/90 seconds data pack logging is configurable. Fault Tolerance capabilities are also built in the MEP 660 Control System, for certain faults. In such cases, the operation of the locomotive continues in the normal way and the fault is logged in the error log with data packs for later analysis and corrective action by the maintenance staff.

5. The MEP 660 Control System has number of test modes, which help maintenance staff in identification and rectification of faults quickly.
6. The MEP 660 Control System has no. of user programmable parameters, which permits the system to be used on various types of locomotives with different types of traction equipments.
7. The MEP 660 Control System displays various operating parameters on the Display Unit continuously from the selected predefined groups for the benefit of the driver and maintenance staff.

1400HP DEMU – DIFFERENT CONTROL CIRCUIT



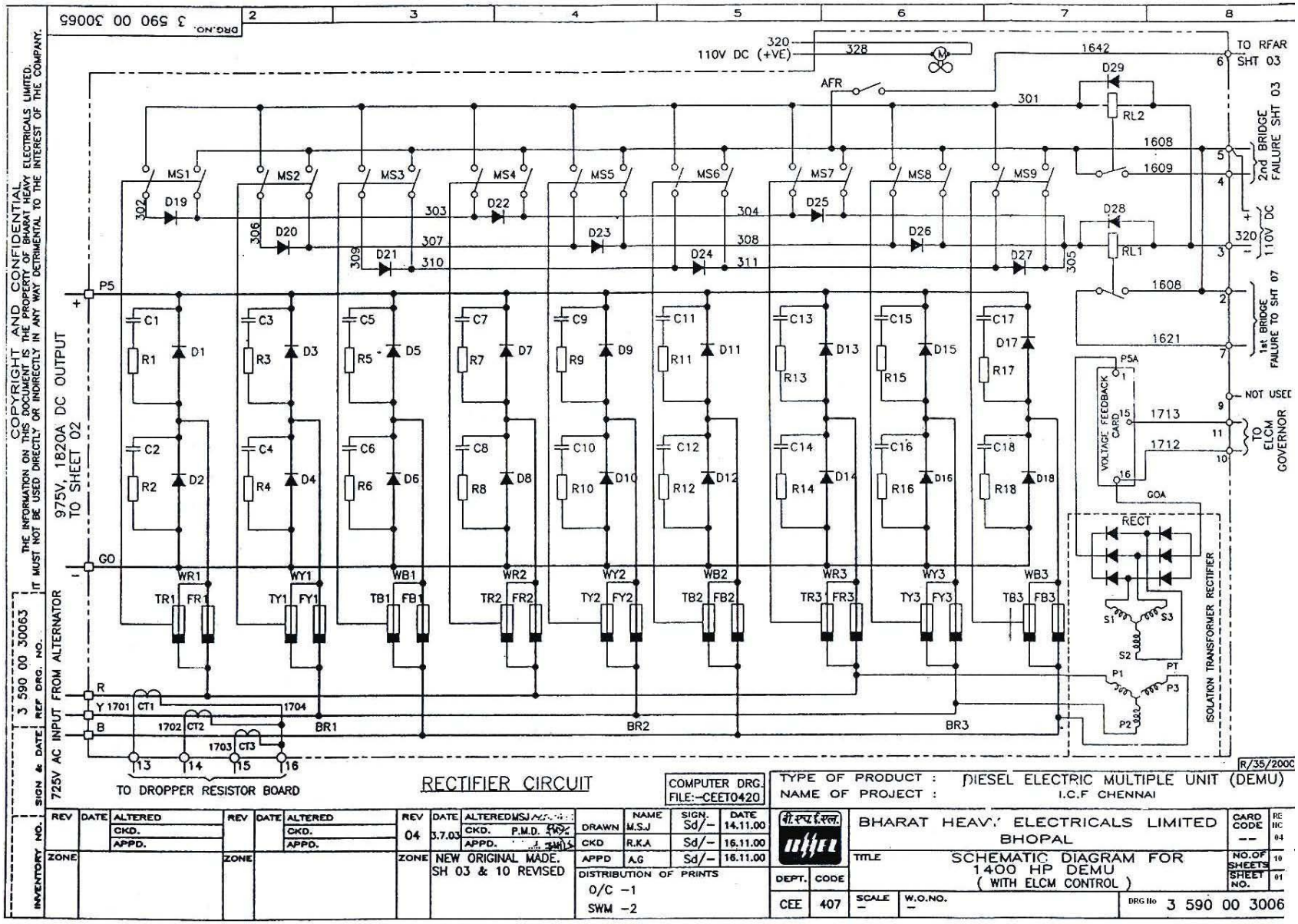


Fig No.15.2 : Schematic Diagram for 1400 HP DEMU with ELCM control

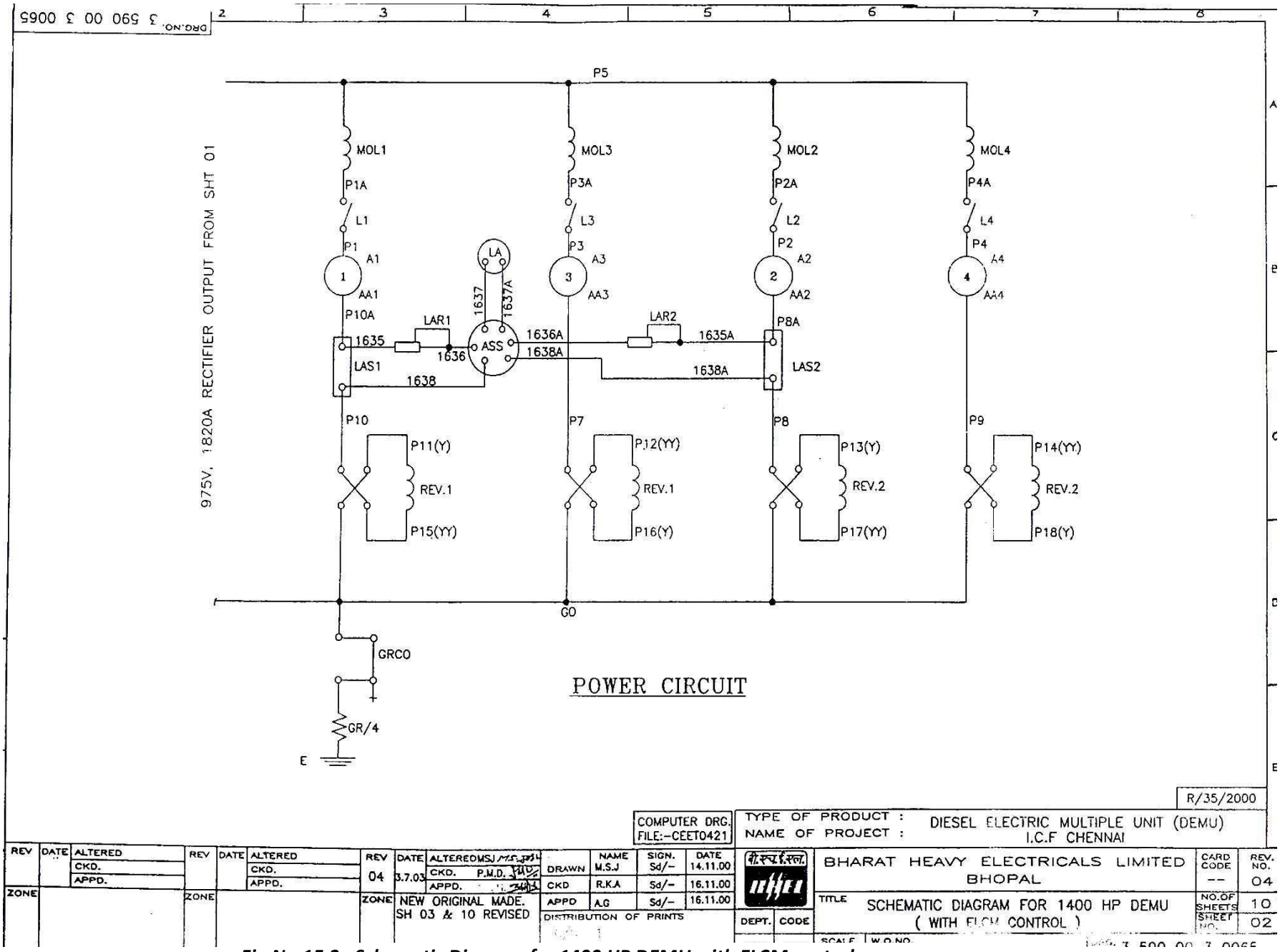


Fig No.15.3 : Schematic Diagram for 1400 HP DEMU with ELCM control

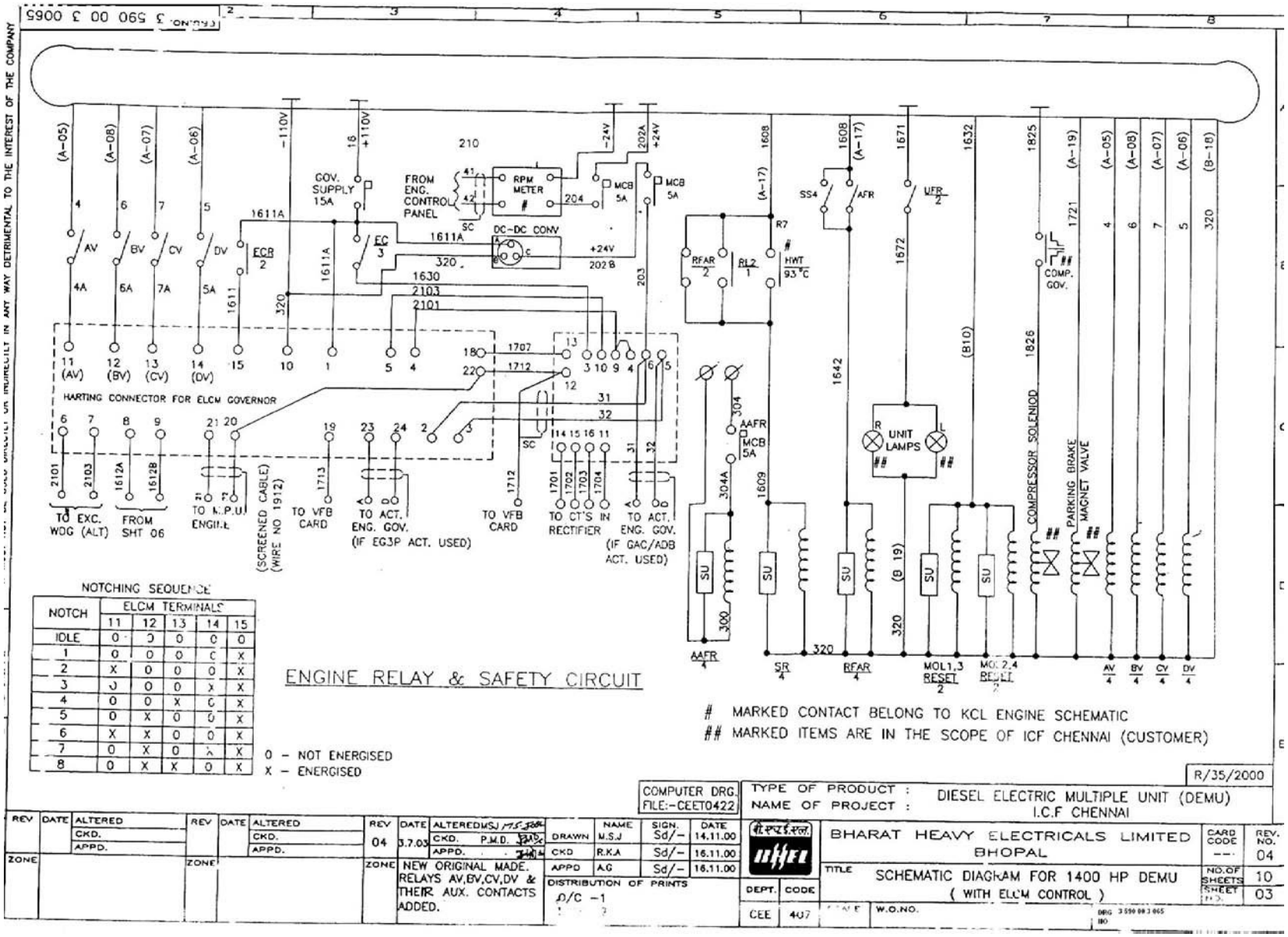


Fig No.15.4 : Schematic Diagram for 1400 HP DEMU with ELCM control

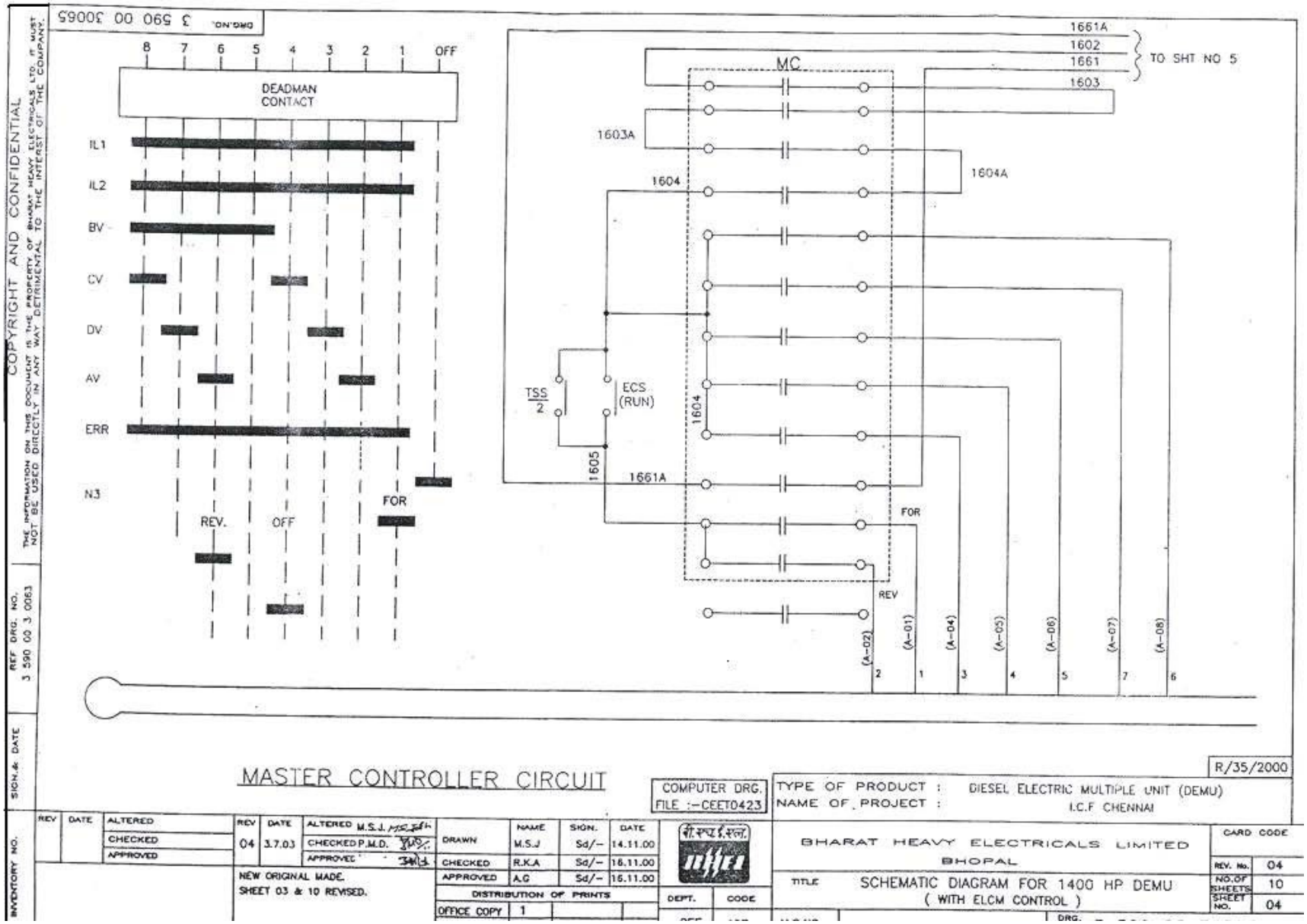


Fig No.15.5 : Schematic Diagram for 1400 HP DEMU with ELCM control

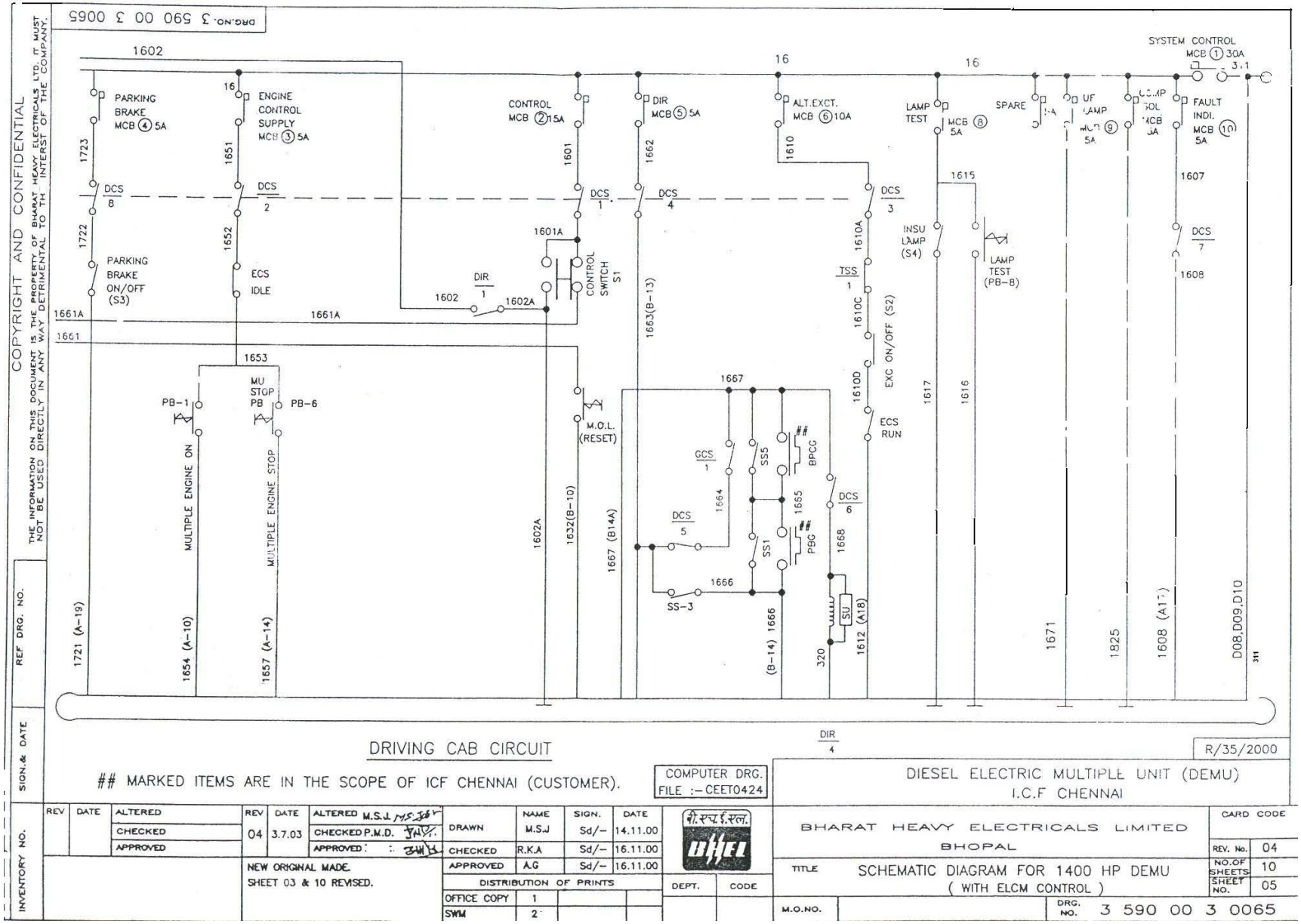


Fig No.15.6 : Schematic Diagram for 1400 HP DEMU with ELCM control

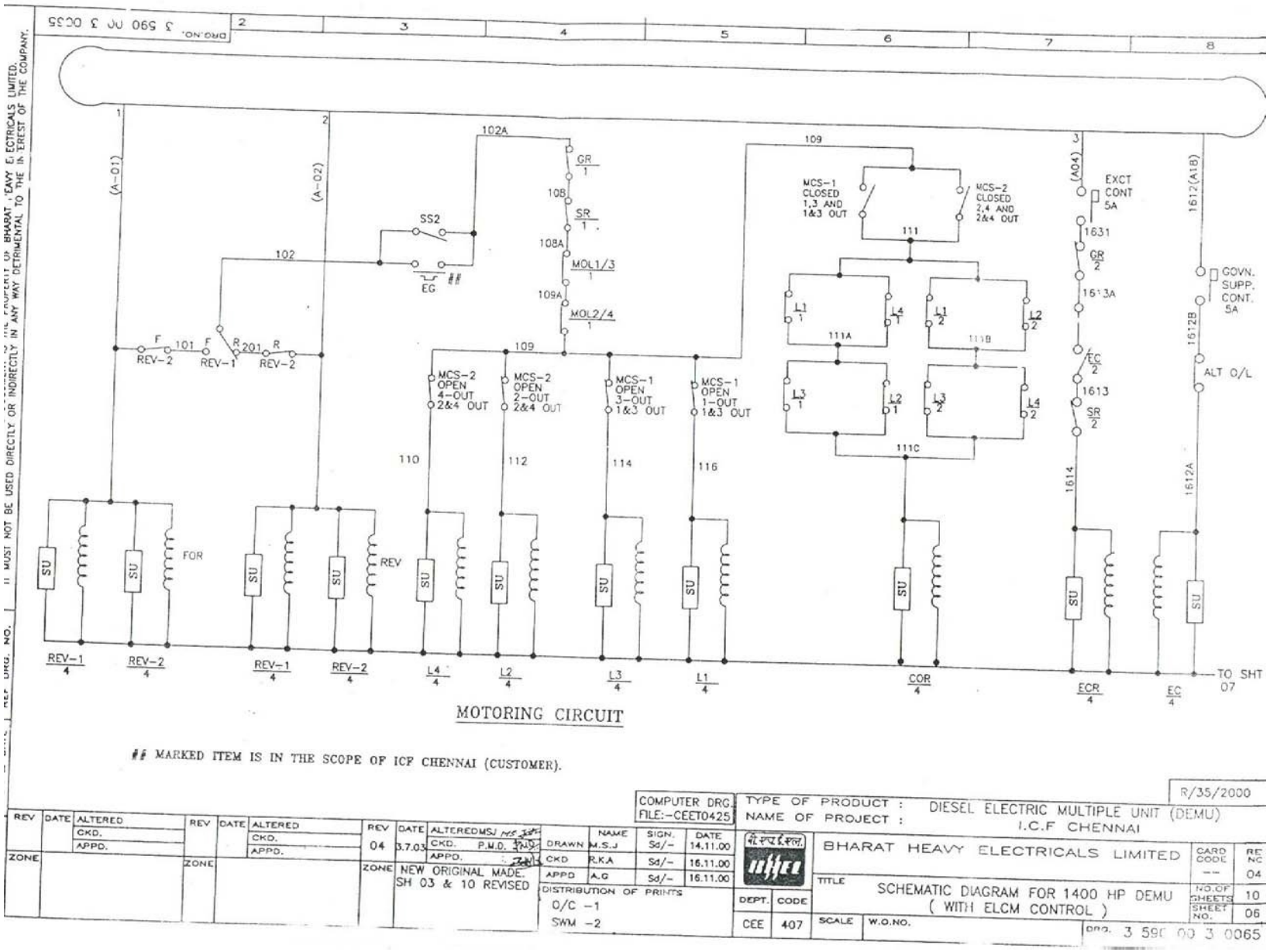


Fig No.15.7 : Schematic Diagram for 1400 HP DEMU with ELCM control

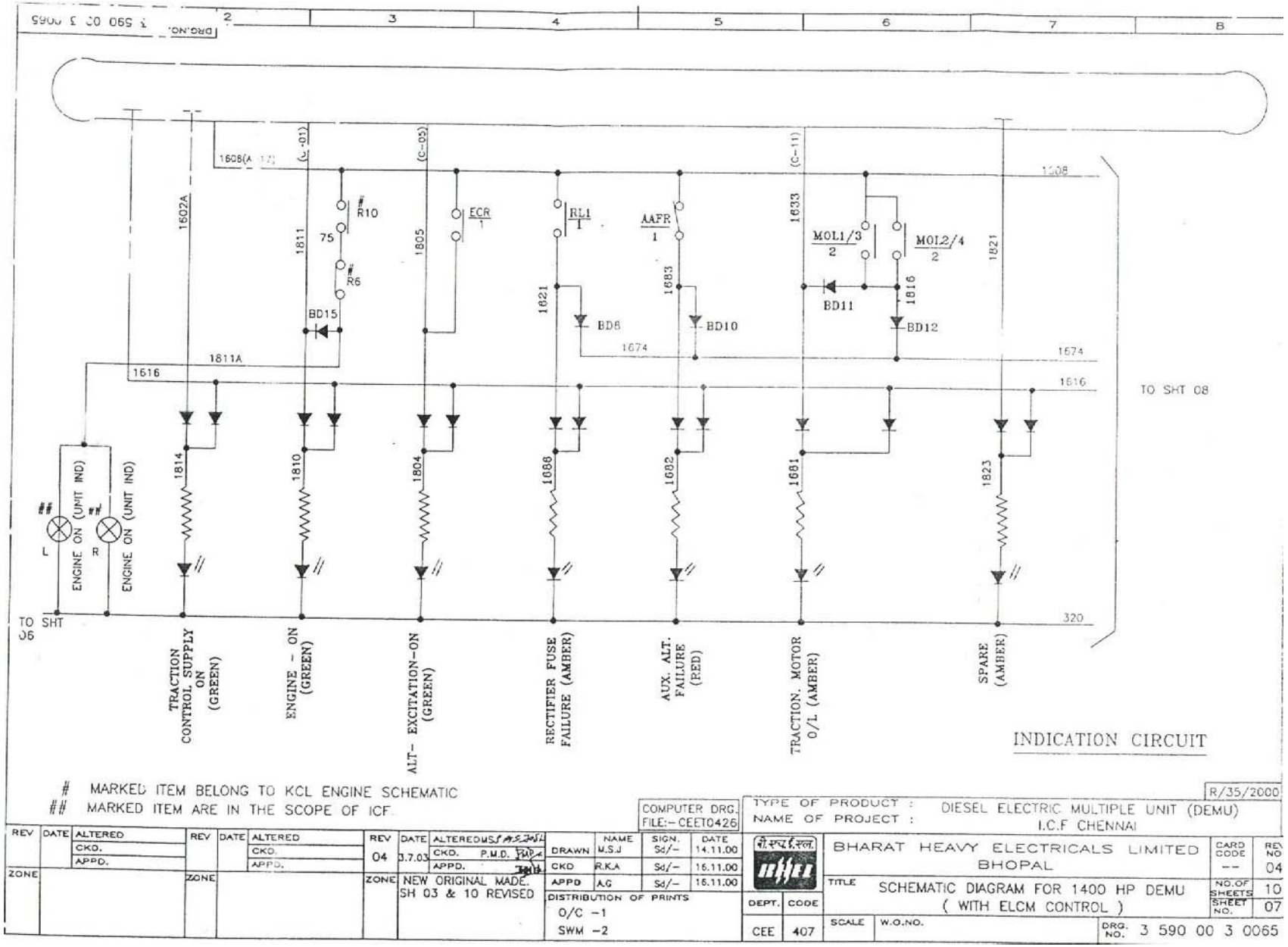


Fig No.15.8 : Schematic Diagram for 1400 HP DEMU with ELCM control

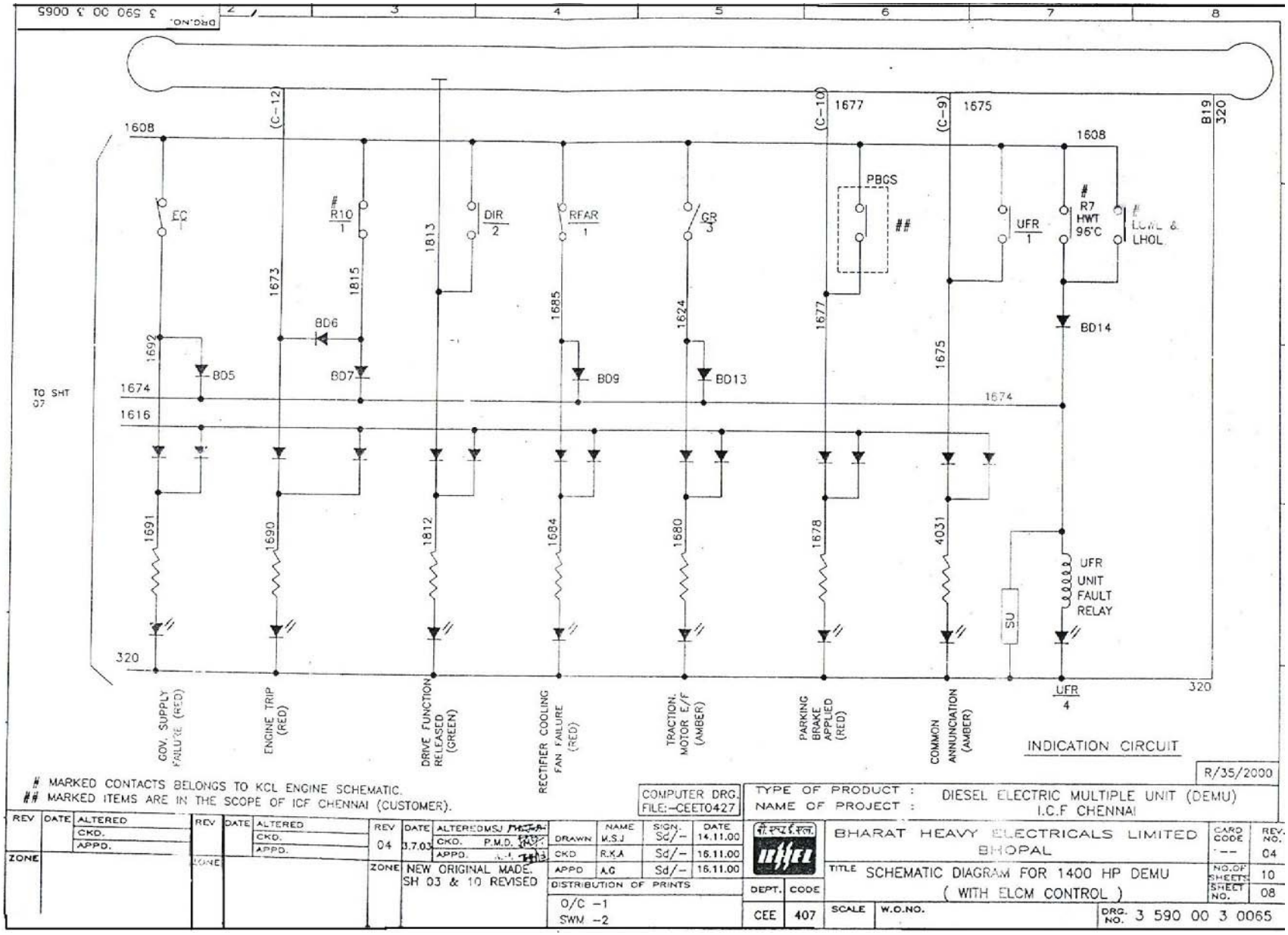
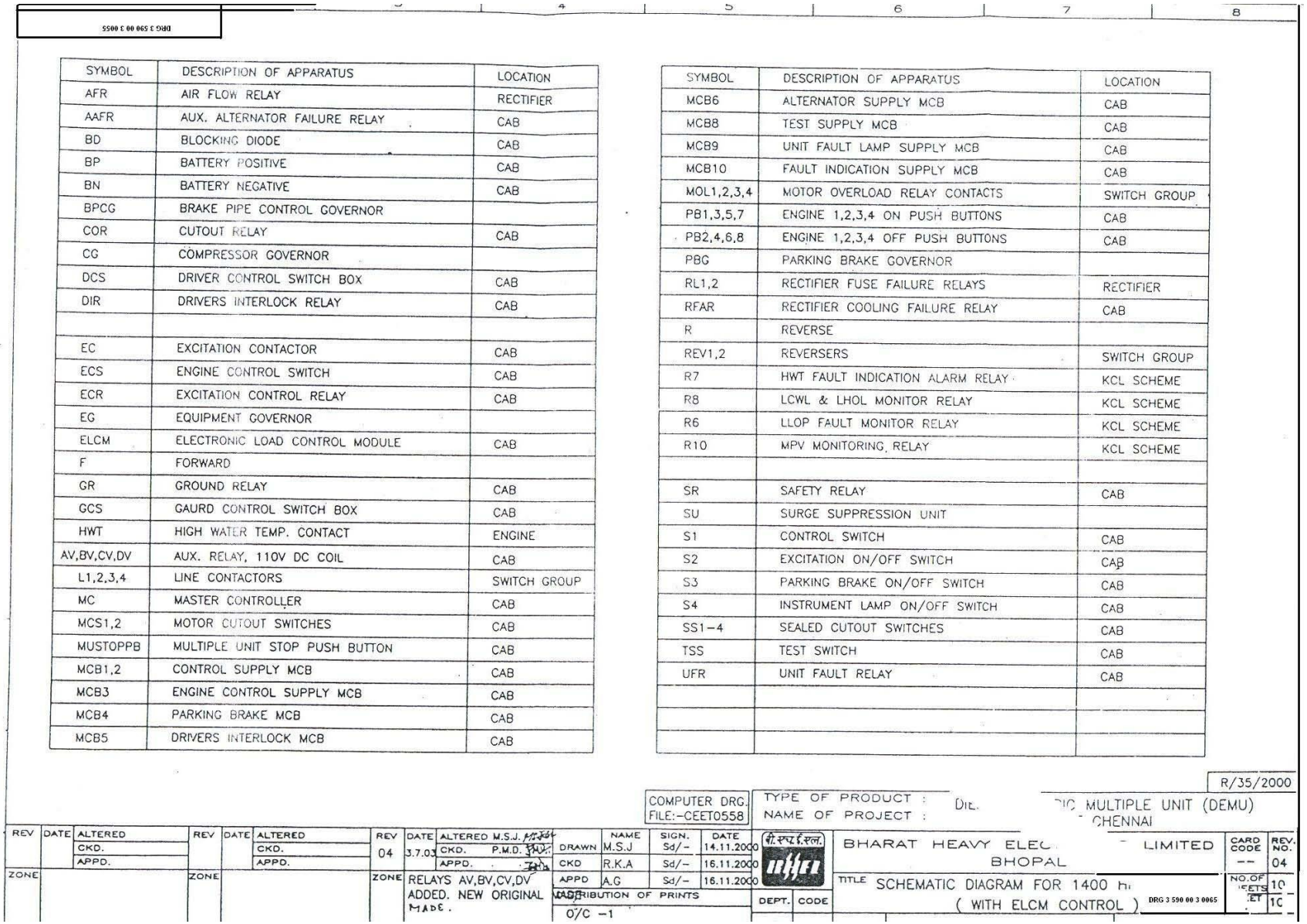


Fig No.15.9 : Schematic Diagram for 1400 HP DEMU with ELCM control



SYMBOL	DESCRIPTION OF APPARATUS	LOCATION
AFR	AIR FLOW RELAY	RECTIFIER
AAFR	AUX. ALTERNATOR FAILURE RELAY	CAB
BD	BLOCKING DIODE	CAB
BP	BATTERY POSITIVE	CAB
BN	BATTERY NEGATIVE	CAB
BPCG	BRAKE PIPE CONTROL GOVERNOR	
COR	CUTOUT RELAY	CAB
CG	COMPRESSOR GOVERNOR	
DCS	DRIVER CONTROL SWITCH BOX	CAB
DIR	DRIVERS INTERLOCK RELAY	CAB
EC	EXCITATION CONTACTOR	CAB
ECS	ENGINE CONTROL SWITCH	CAB
ECR	EXCITATION CONTROL RELAY	CAB
EG	EQUIPMENT GOVERNOR	
ELCM	ELECTRONIC LOAD CONTROL MODULE	CAB
F	FORWARD	
GR	GROUND RELAY	CAB
GCS	GAURD CONTROL SWITCH BOX	CAB
HWT	HIGH WATER TEMP. CONTACT	ENGINE
AV,BV,CV,DV	AUX. RELAY, 110V DC COIL	CAB
L1,2,3,4	LINE CONTACTORS	SWITCH GROUP
MC	MASTER CONTROLLER	CAB
MCS1,2	MOTOR CUTOUT SWITCHES	CAB
MUSTOPPB	MULTIPLE UNIT STOP PUSH BUTTON	CAB
MCB1,2	CONTROL SUPPLY MCB	CAB
MCB3	ENGINE CONTROL SUPPLY MCB	CAB
MCB4	PARKING BRAKE MCB	CAB
MCB5	DRIVERS INTERLOCK MCB	CAB

SYMBOL	DESCRIPTION OF APPARATUS	LOCATION
MCB6	ALTERNATOR SUPPLY MCB	CAB
MCB8	TEST SUPPLY MCB	CAB
MCB9	UNIT FAULT LAMP SUPPLY MCB	CAB
MCB10	FAULT INDICATION SUPPLY MCB	CAB
MOL1,2,3,4	MOTOR OVERLOAD RELAY CONTACTS	SWITCH GROUP
PB1,3,5,7	ENGINE 1,2,3,4 ON PUSH BUTTONS	CAB
PB2,4,6,8	ENGINE 1,2,3,4 OFF PUSH BUTTONS	CAB
PBG	PARKING BRAKE GOVERNOR	
RL1,2	RECTIFIER FUSE FAILURE RELAYS	RECTIFIER
RFAR	RECTIFIER COOLING FAILURE RELAY	CAB
R	REVERSE	
REV1,2	REVERSERS	SWITCH GROUP
R7	HWT FAULT INDICATION ALARM RELAY	KCL SCHEME
R8	LCWL & LHOL MONITOR RELAY	KCL SCHEME
R6	LLOP FAULT MONITOR RELAY	KCL SCHEME
R10	MPV MONITORING, RELAY	KCL SCHEME
SR	SAFETY RELAY	CAB
SU	SURGE SUPPRESSION UNIT	
S1	CONTROL SWITCH	CAB
S2	EXCITATION ON/OFF SWITCH	CAB
S3	PARKING BRAKE ON/OFF SWITCH	CAB
S4	INSTRUMENT LAMP ON/OFF SWITCH	CAB
SS1-4	SEALED CUTOUT SWITCHES	CAB
TSS	TEST SWITCH	CAB
UFR	UNIT FAULT RELAY	CAB

Fig 15.10 ***Schematic Diagram for 1400 HP DEMU with ELCM control***

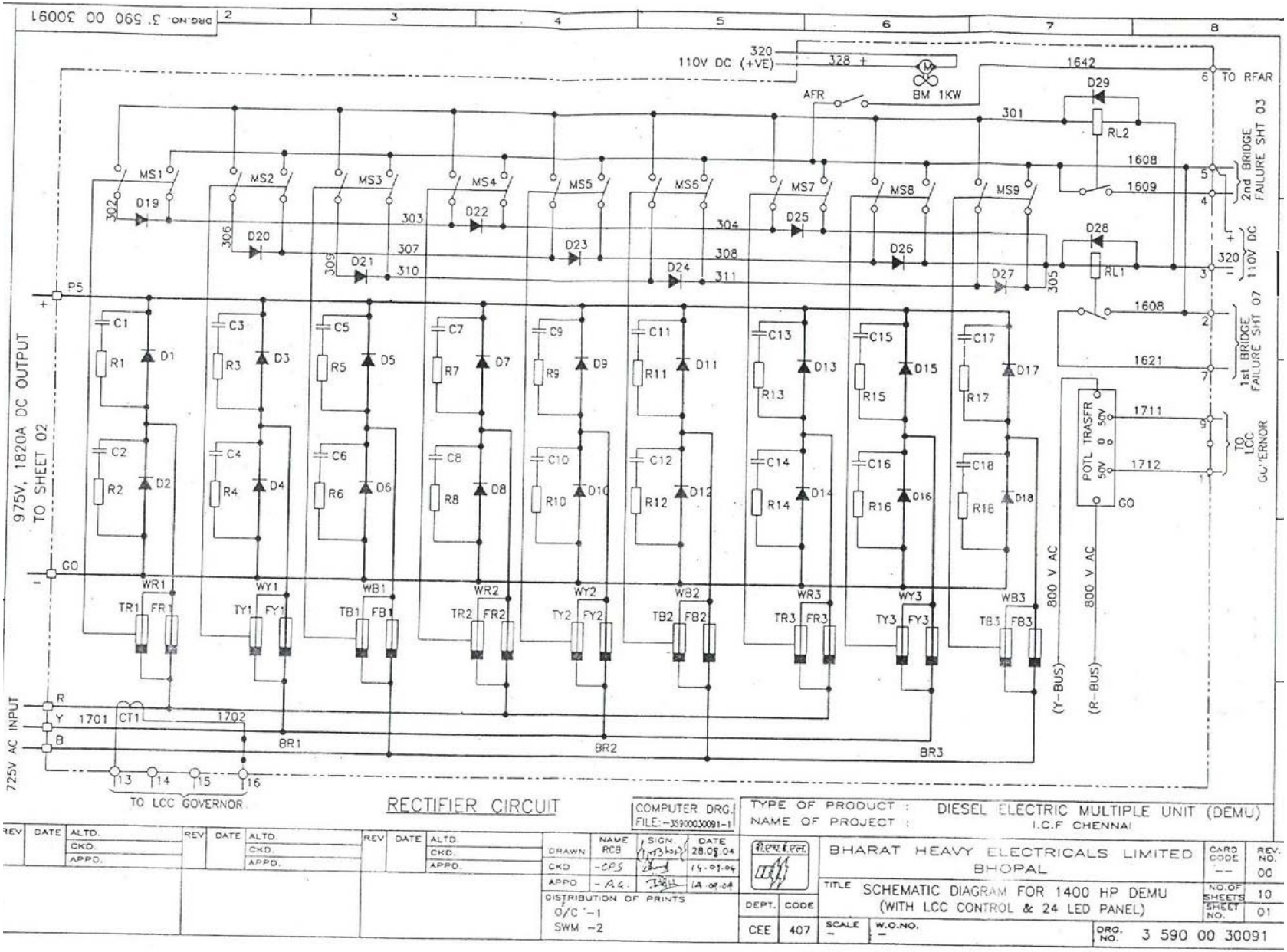


Fig 15.11 Schematic Diagram for 1400 HP DEMU with LCC Control & 24 LED Panel

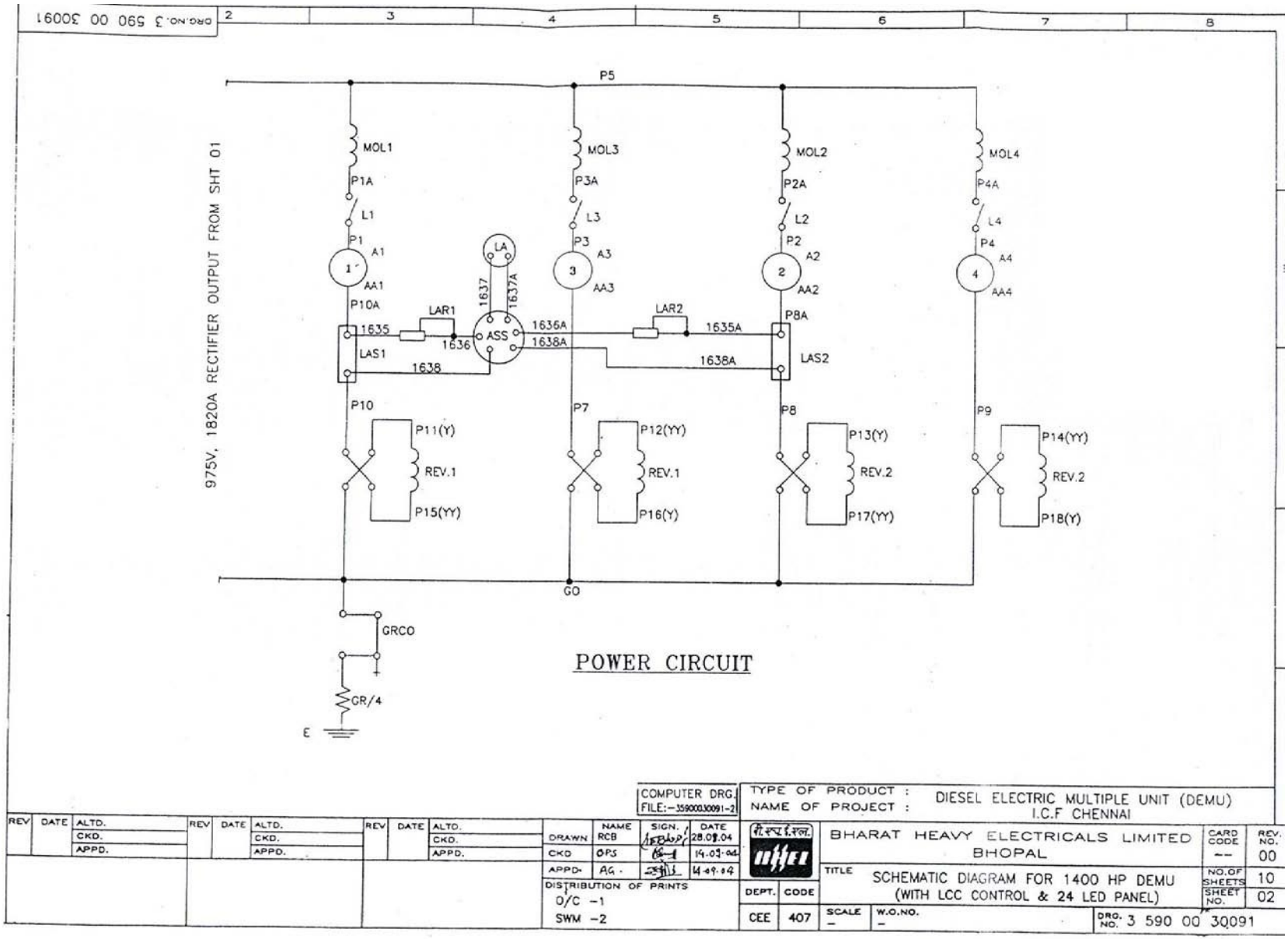


Fig 15.12 Schematic Diagram for 1400 HP DEMU with LCC Control & 24 LED Panel

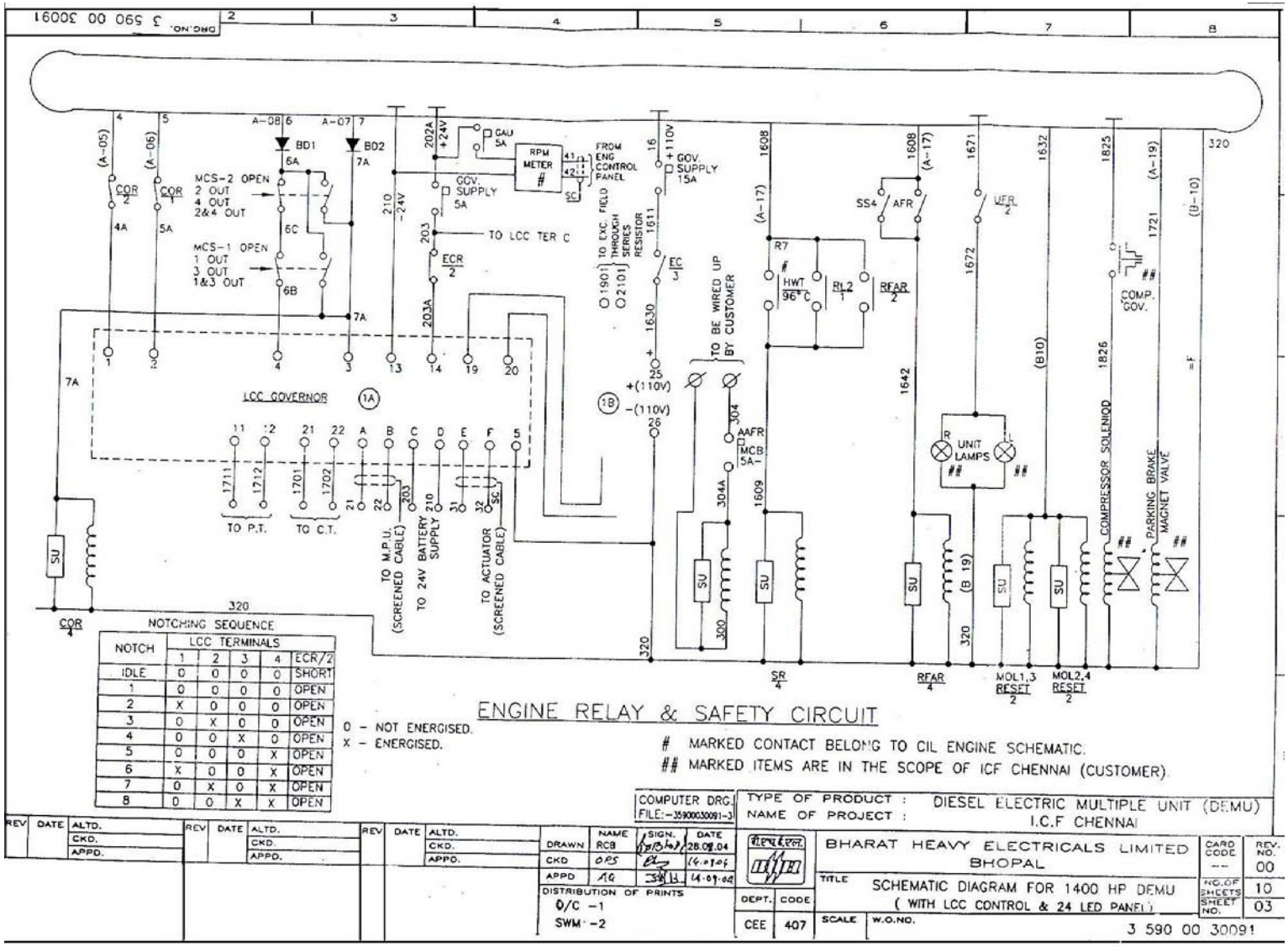


Fig 15.13 Schematic Diagram for 1400 HP DEMU with LCC Control & 24 LED Panel

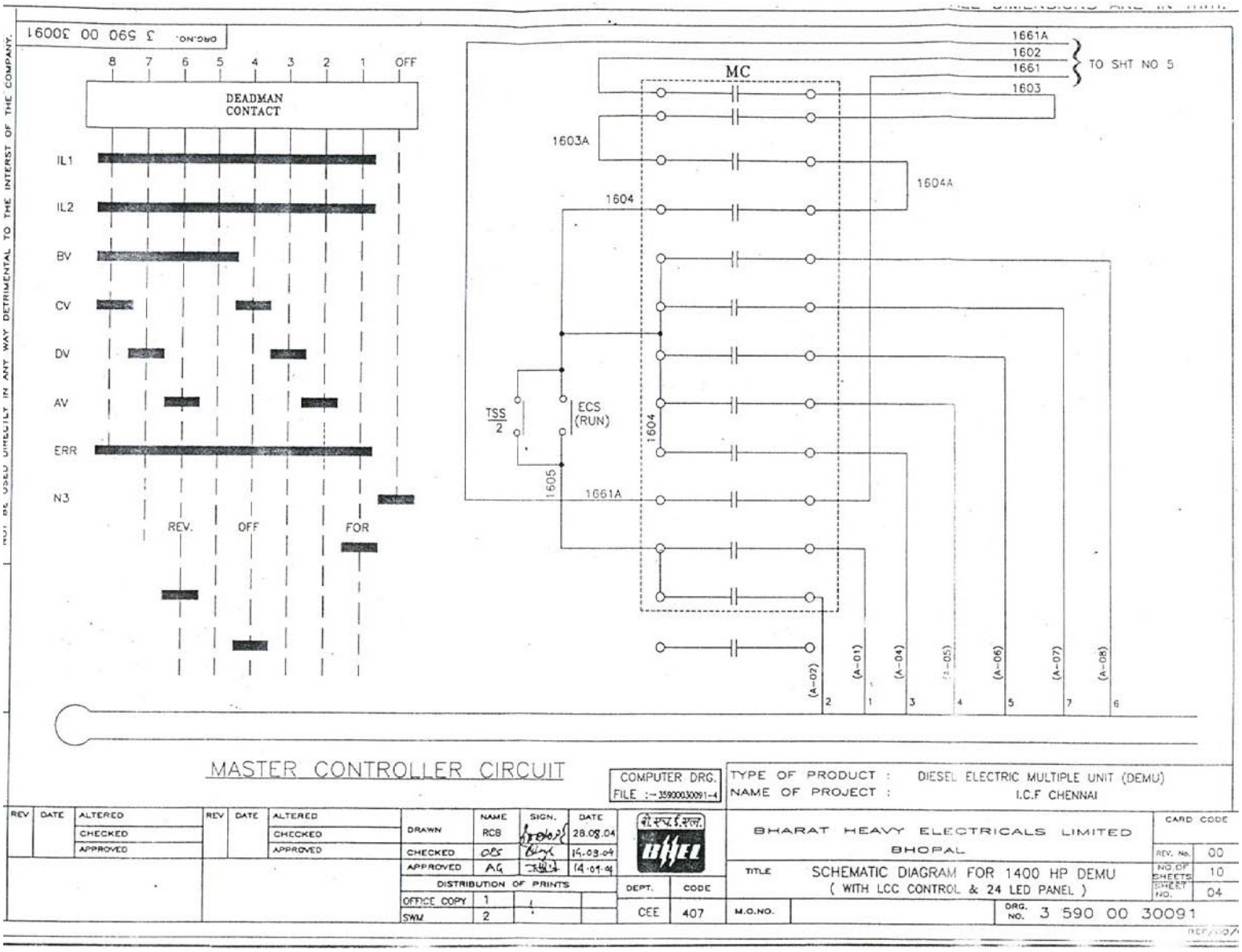


Fig 15.14 Schematic Diagram for 1400 HP DEMU with LCC Control & 24 LED Panel

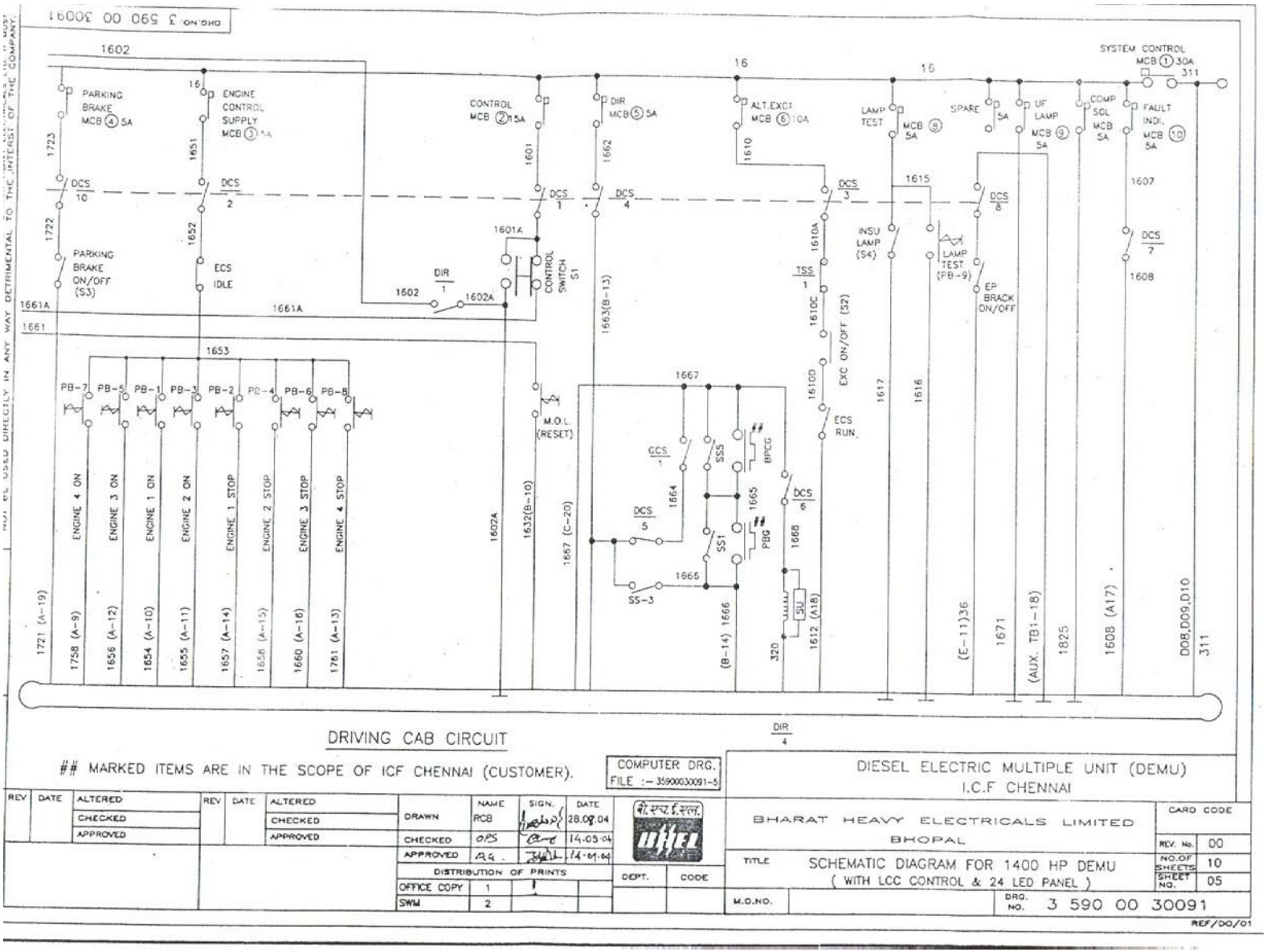


Fig 15.15 Schematic Diagram for 1400 HP DEMU with LCC Control & 24 LED Panel

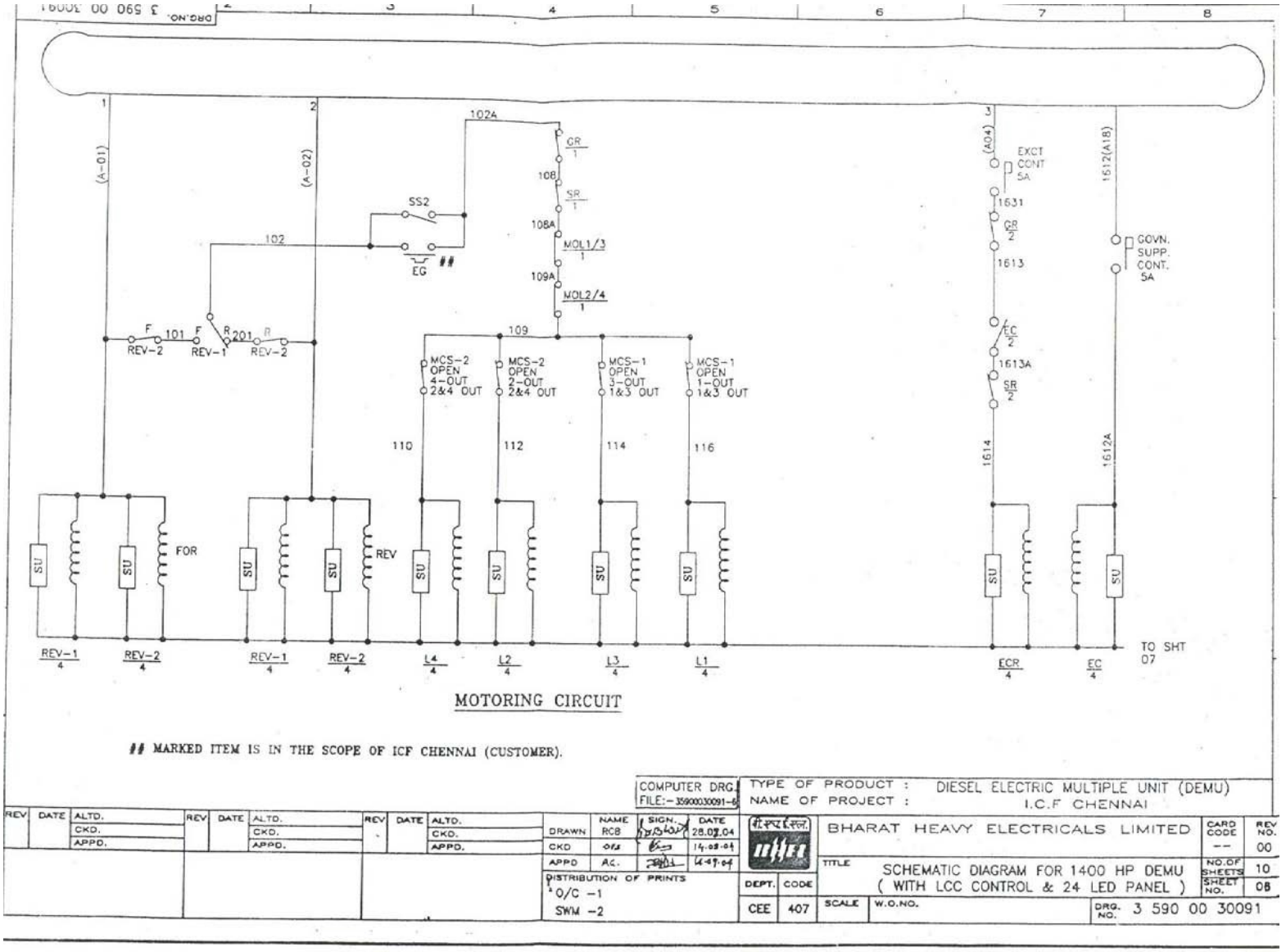


Fig 15.16 Schematic Diagram for 1400 HP DEMU with LCC Control & 24 LED Panel

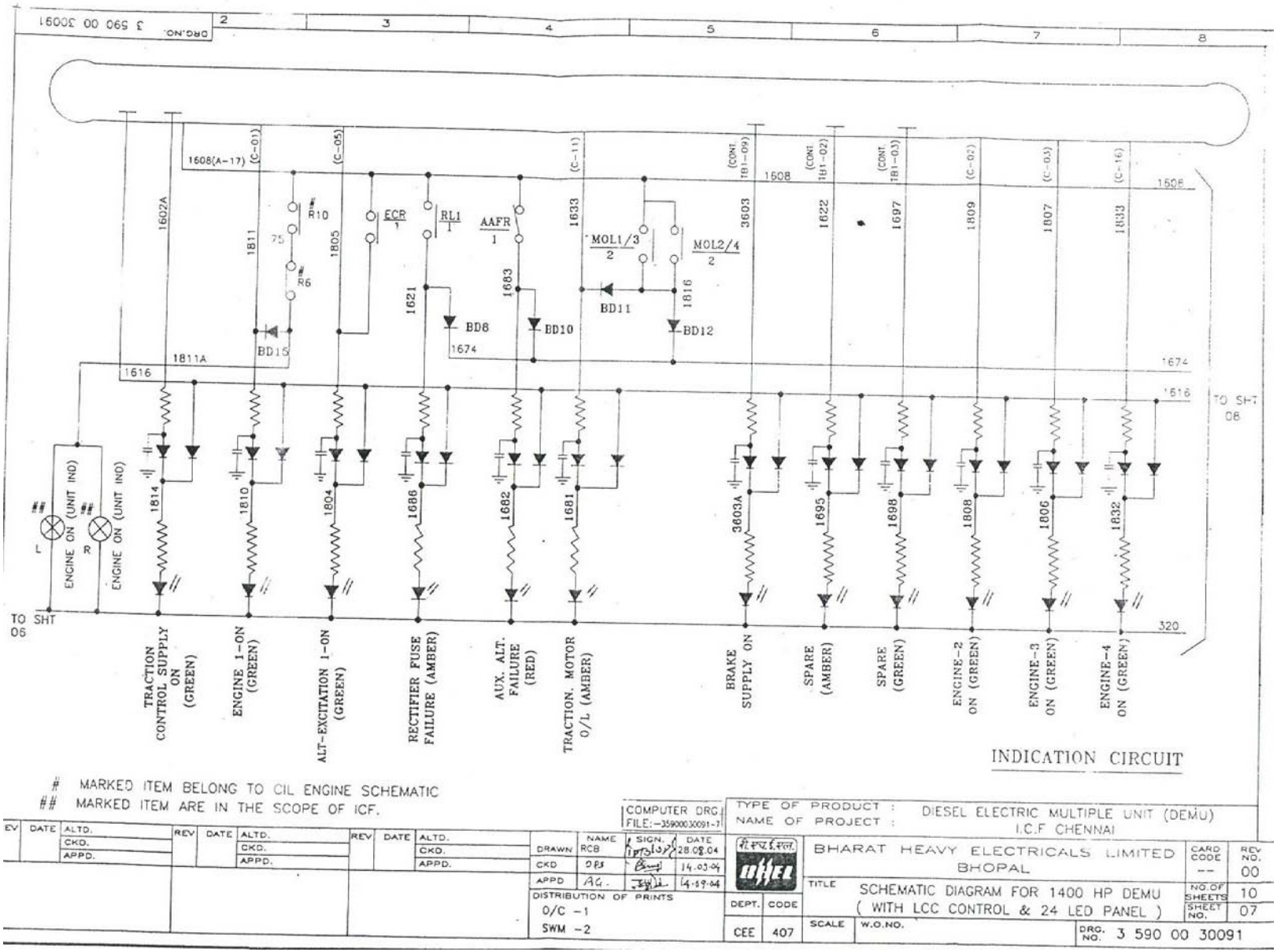


Fig 15.17 Schematic Diagram for 1400 HP DEMU with LCC Control & 24 LED Panel

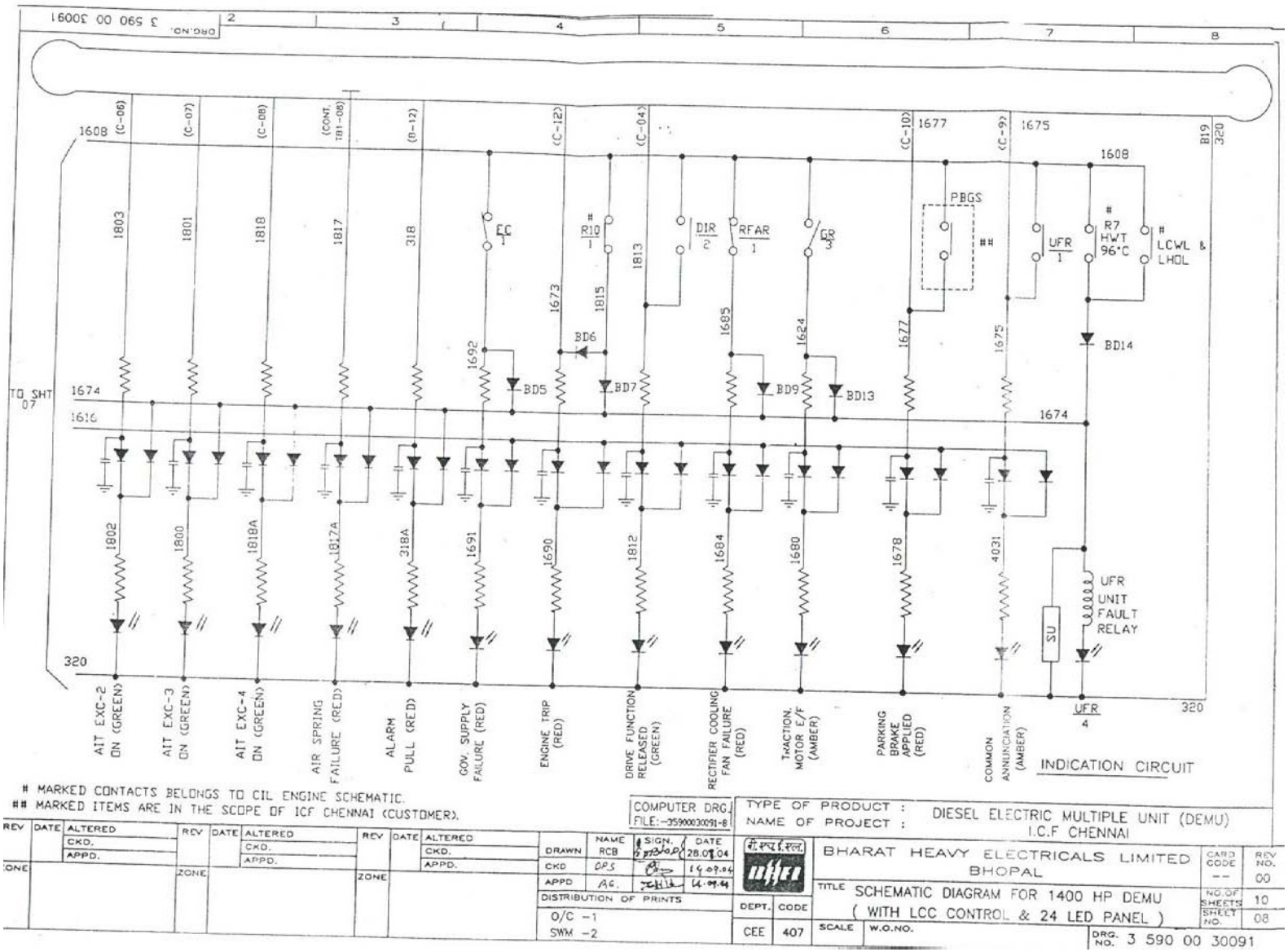


Fig 15.18 Schematic Diagram for 1400 HP DEMU with LCC Control & 24 LED Panel

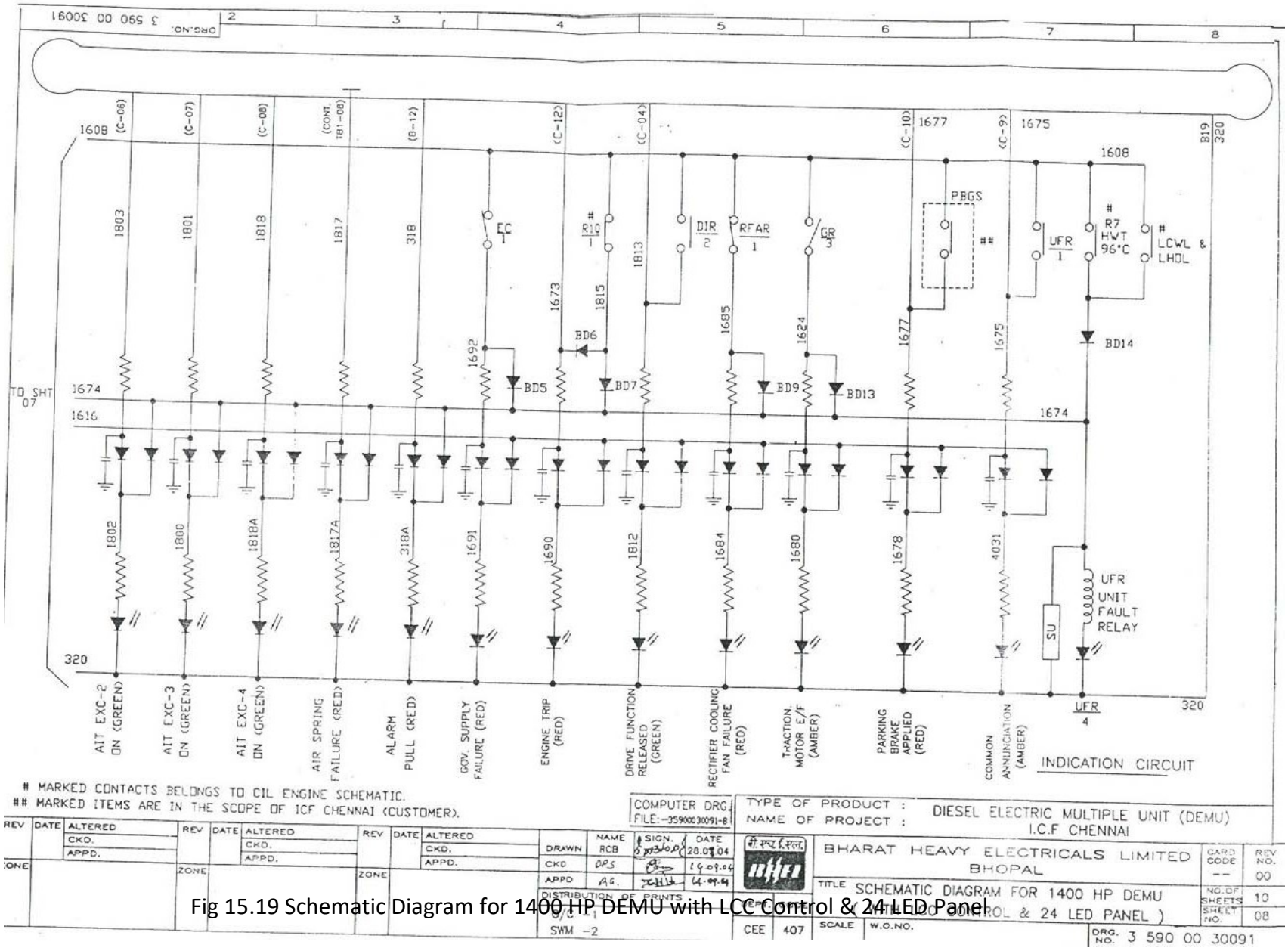


Fig 15.19 Schematic Diagram for 1400 HP DEMU with LCC Control & 24 LED Panel

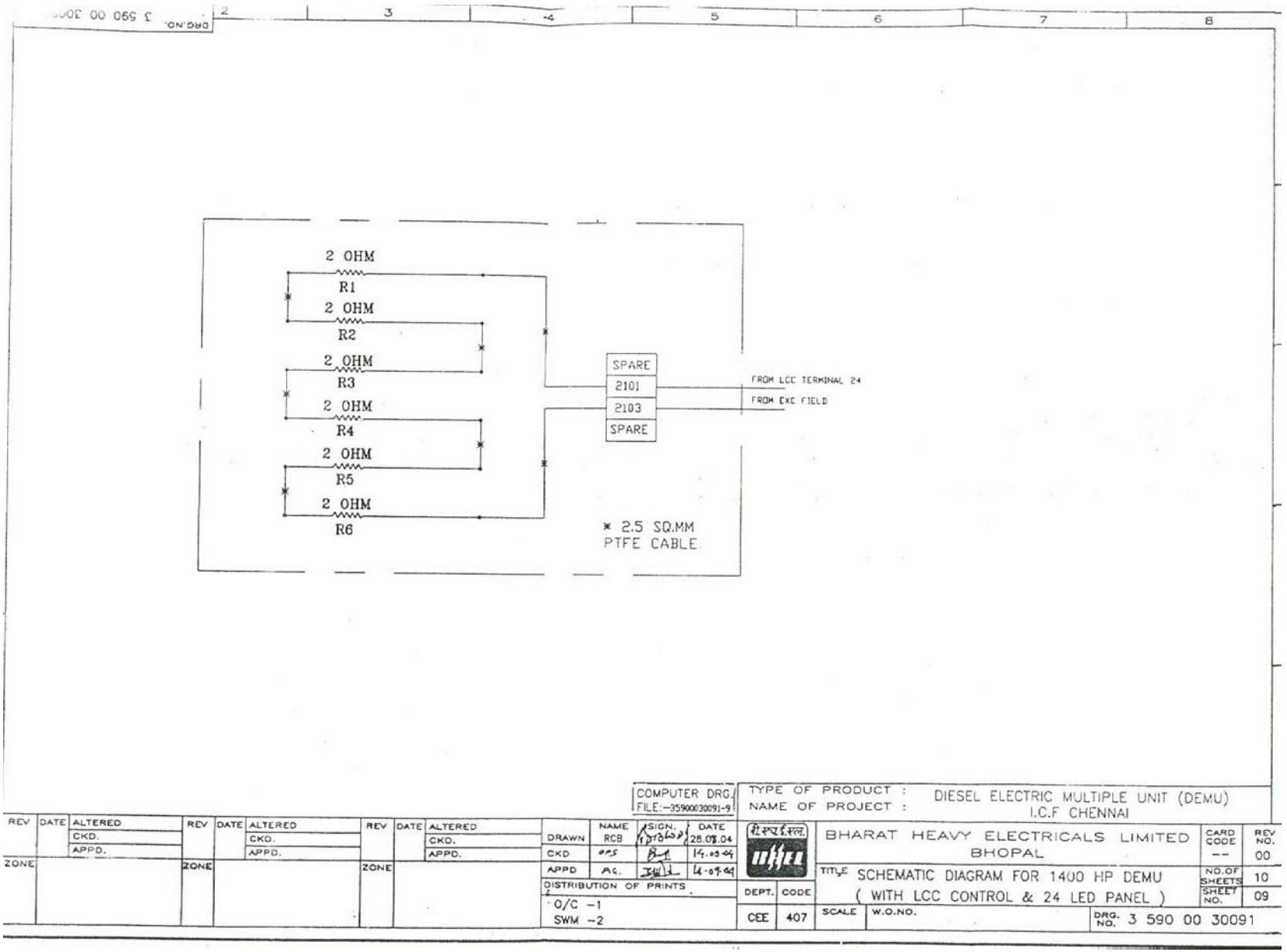


Fig 15. 20 Schematic Diagram for 1400 HP DEMU with LCC Control & 24 LED Panel

SYMBOL	DESCRIPTION OF APPARATUS	LOCATION
AFR	AIR FLOW RELAY	RECTIFIER
AAFR	AUX. ALTERNATOR FAILURE RELAY	CAB
BD	BLOCKING DIODE	CAB
BP	BATTERY POSITIVE	CAB
BN	BATTERY NEGATIVE	CAB
BPCG	BRAKE PIPE CONTROL GOVERNOR	
CDR	CUTOUT RELAY	CAB
CG	COMPRESSOR GOVERNOR	
DCS	DRIVER CONTROL SWITCH BOX	CAB
DIR	DRIVERS INTERLOCK RELAY	CAB
EC	EXCITATION CONTACTOR	CAB
ECS	ENGINE CONTROL SWITCH	CAB
ECR	EXCITATION CONTROL RELAY	CAB
EG	EQUIPMENT GOVERNOR	
LCC	LOCO SPEED & LOAD CONTROL	CAB
F	FORWARD	
GR	GROUND RELAY	CAB
GCS	GAURD CONTROL SWITCH BOX	CAB
HWT	HIGH WATER TEMP. CONTACT	ENGINE
L1,2,3,4	LINE CONTACTORS	SWITCH GROUP
MC	MASTER CONTROLLER	CAB
MCS1,2	MOTOR CUTOUT SWITCHES	CAB
MUSTOPPB	MULTIPLE UNIT STOP PUSH BUTTON	CAB
MCB1,2	CONTROL SUPPLY MCB	CAB
MCB3	ENGINE CONTROL SUPPLY MCB	CAB
MCB4	PARKING BRAKE MCB	CAB
MCB5	DRIVERS INTERLOCK MCB	CAB

SYMBOL	DESCRIPTION OF APPARATUS	LOCATION
MCB6	ALTERNATOR SUPPLY MCB	CAB
MCB8	TEST SUPPLY MCB	CAB
MCB9	UNIT FAULT LAMP SUPPLY MCB	CAB
MCB10	FAULT INDICATION SUPPLY MCB	CAB
MOL1,2,3,4	MOTOR OVERLOAD RELAY CONTACTS	SWITCH GROUP
PB1,3,5,7	ENGINE 1,2,3,4 ON PUSH BUTTONS	CAB
PB2,4,6,8	ENGINE 1,2,3,4 OFF PUSH BUTTONS	CAB
PBG	PARKING BRAKE GOVERNOR	
RL1,2	RECTIFIER FUSE FAILURE RELAYS	RECTIFIER
RFAR	RECTIFIER COOLING FAILURE RELAY	CAB
R	REVERSE	
REV1,2	REVERSERS	SWITCH GROUP
R7	HWT FAULT INDICATION ALARM RELAY	KCL SCHEME
R8	LCWL & LHOL MONITOR RELAY	KCL SCHEME
R6	LLOP FAULT MONITOR RELAY	KCL SCHEME
R10	MPV MONITORING RELAY	KCL SCHEME
SR	SAFETY RELAY	CAB
SU	SURGE SUPPRESSION UNIT	
S1	CONTROL SWITCH	CAB
S2	EXCITATION ON/OFF SWITCH	CAB
S3	PARKING BRAKE ON/OFF SWITCH	CAB
S4	INSTRUMENT LAMP ON/OFF SWITCH	CAB
SS1-4	SEALED CUTOUT SWITCHES	CAB
TSS	TEST SWITCH	CAB
UFR	UNIT FAULT RELAY	CAB
TB9	LAMP TEST	CAB

COMPUTER DRG. FILE:-3590003009I-10

TYPE OF PRODUCT : DIESEL ELECTRIC MULTIPLE UNIT (DEMU)
NAME OF PROJECT : I.C.F CHENNAI

REV	DATE	ALTERED	REV	DATE	ALTERED	REV	DATE	ALTERED
		CKD.			CKD.			CKD.
		APPD.			APPD.			APPD.
ZONE			ZONE			ZONE		

	NAME	SIGN.	DATE
DRAWN	RCB		28.08.04
CKD			14.09.04
APPD			14.09.04

DISTRIBUTION OF PRINTS
O/C -1
SWM -2

BHARAT HEAVY ELECTRICALS LIMITED
BHOPAL

TITLE SCHEMATIC DIAGRAM FOR 1400 HP DEMU (WITH LCC CONTROL & 24 LED PANEL)

DEPT.	CODE
CEE	407

SCALE | W.O.NO. | DRG. NO. 3 590 00 30091

CARD CODE -- | REV NO. 00 | NO. OF SHEETS 10 | SHEET NO. 10

Fig 15.21 Schematic Diagram for 1400 HP DEMU with LCC Control & 24 LED Panel

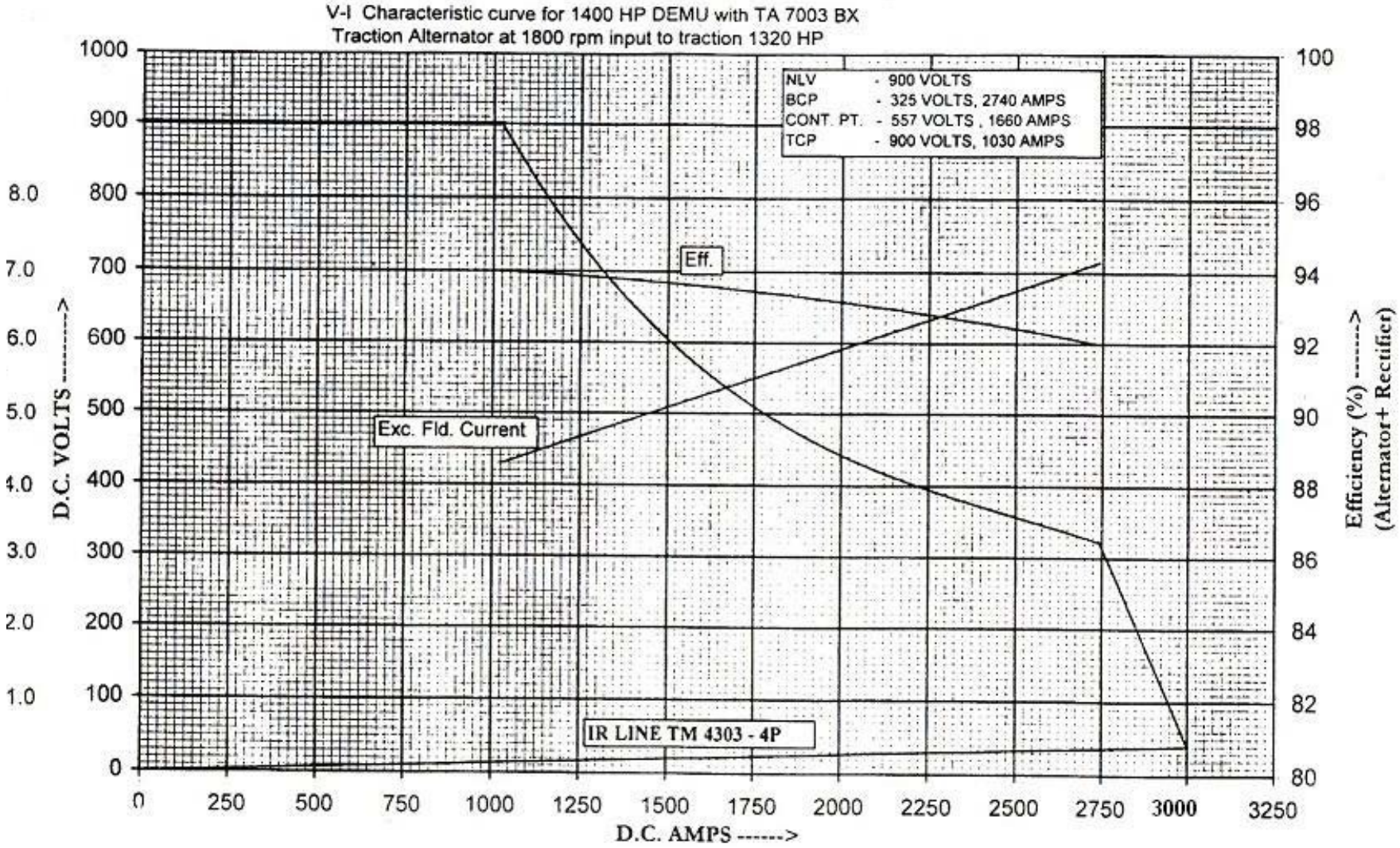

V-I Characteristic curve for 1400 HP DEMU with TA 7003 BX
Traction Alternator at 1800 rpm input to traction 1320 HP
NLV - 900 VOLTS
BCP - 325 VOLTS, 2740 AMPS
CONT. PT. - 557 VOLTS , 1660 AMPS
TCP - 900 VOLTS, 1030 AMPS
Eff.
Exc. Fld. Current
IR LINE TM 4303 - 4P
D.C. VOLTS ------>
Efficiency (%) ------>
(Alternator+ Rectifier)
D.C. AMPS ------>
1000
900
800
700
600
500
400
300
200
100
0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
100
98
96
94
92
90
88
86
84
82
80
0
250
500
750
1000
1250
1500
1750
2000
2250
2500
2750
3000
3250

Fig 15.22

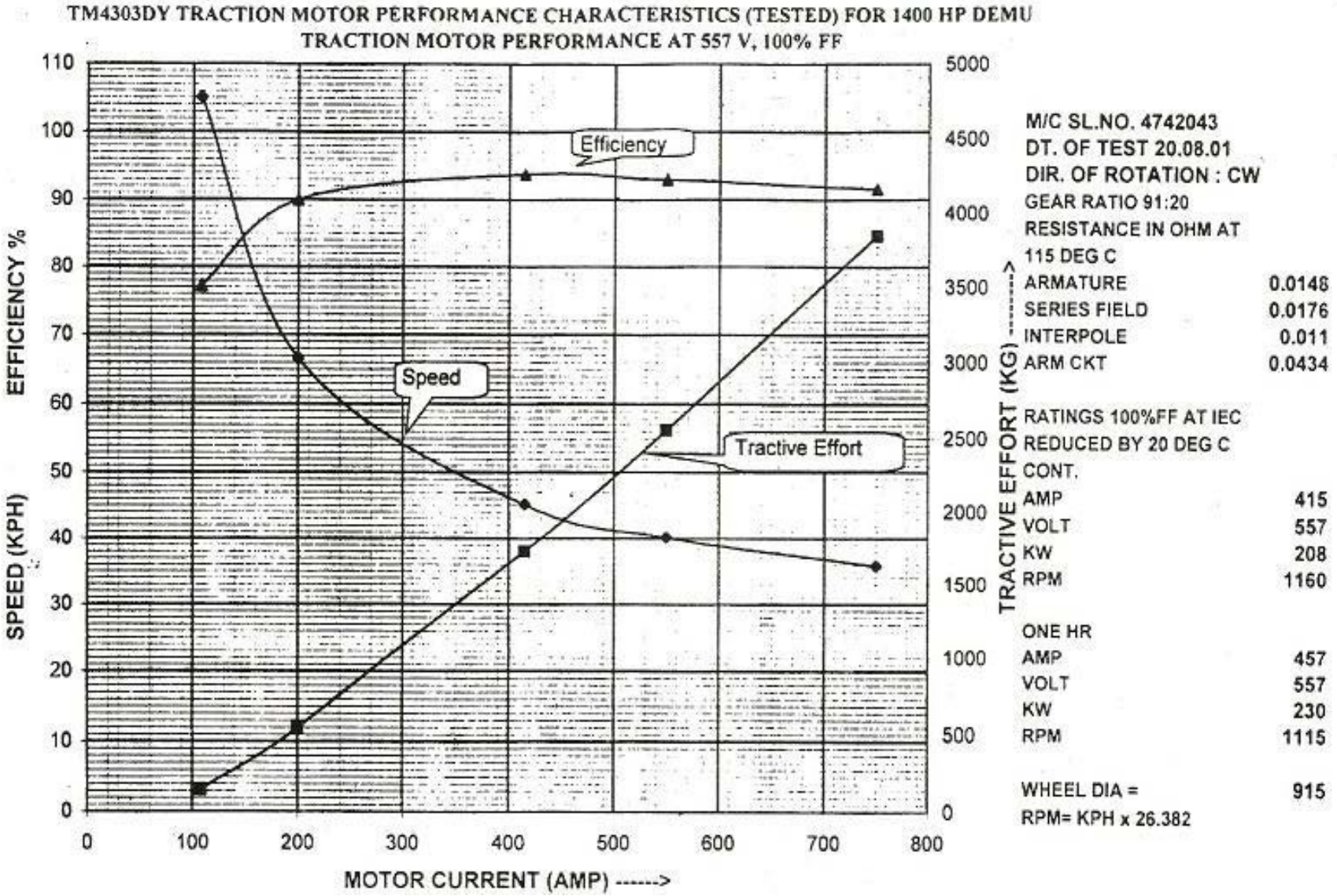

TM4303DY TRACTION MOTOR PERFORMANCE CHARACTERISTICS (TESTED) FOR 1400 HP DEMU
TRACTION MOTOR PERFORMANCE AT 557 V, 100% FF
EFFICIENCY %
SPEED (KPH)
TRACTIVE EFFORT (KG) ------->
MOTOR CURRENT (AMP) ------>
Efficiency
Speed
Tractive Effort
0
10
20
30
40
50
60
70
80
90
100
110
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
0
100
200
300
400
500
600
700
800
M/C SL.NO. 4742043
DT. OF TEST 20.08.01
DIR. OF ROTATION : CW
GEAR RATIO 91:20
RESISTANCE IN OHM AT
115 DEG C
ARMATURE 0.0148
SERIES FIELD 0.0176
INTERPOLE 0.011
ARM CKT 0.0434
RATINGS 100%FF AT IEC
REDUCED BY 20 DEG C
CONT.
AMP 415
VOLT 557
KW 208
RPM 1160
ONE HR
AMP 457
VOLT 557
KW 230
RPM 1115
WHEEL DIA = 915
RPM= KPH x 26.382

Fig 15.23

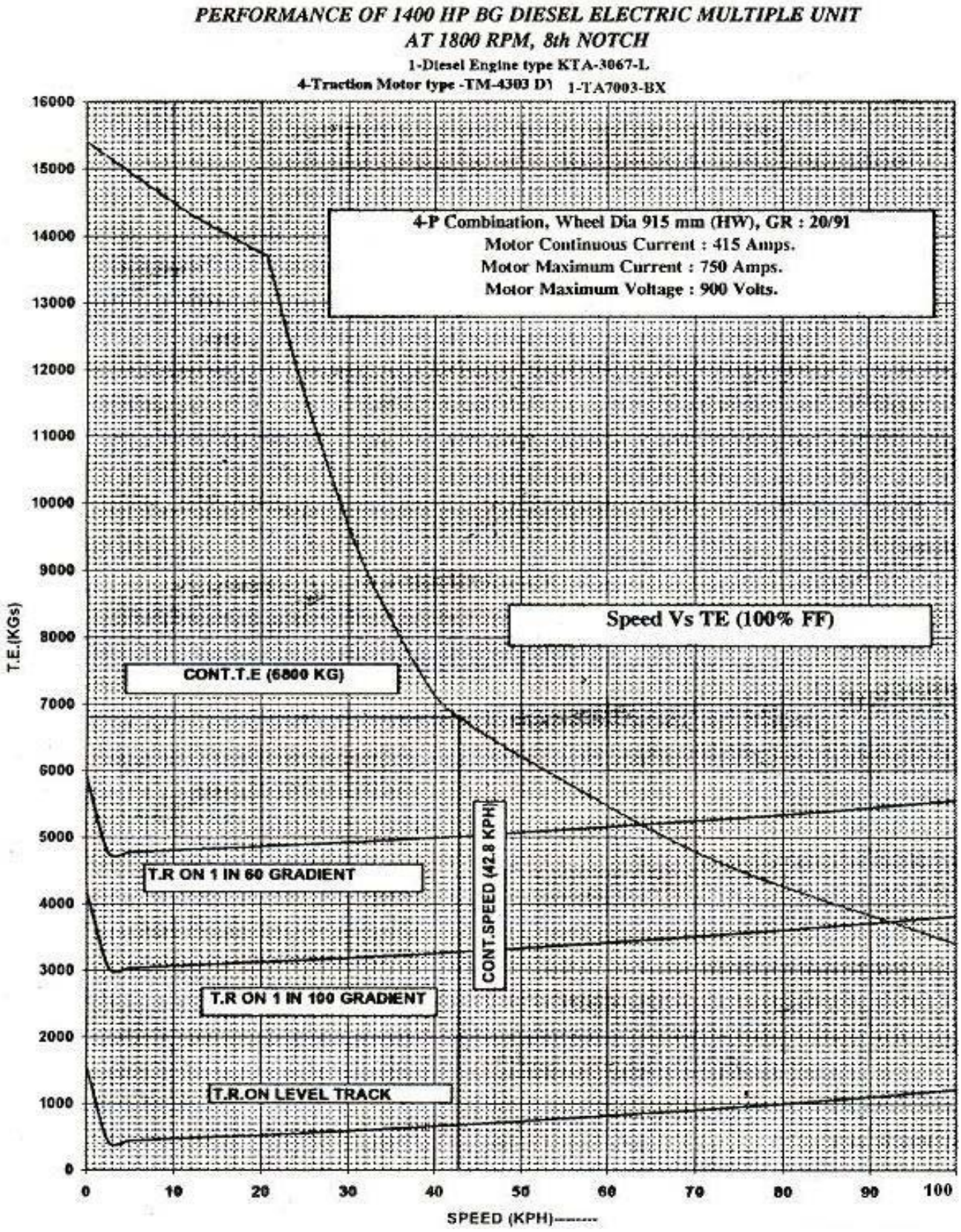

PERFORMANCE OF 1400 HP BG DIESEL ELECTRIC MULTIPLE UNIT
AT 1800 RPM, 8th NOTCH
1-Diesel Engine type KTA-3067-L
4-Traction Motor type -TM-4303 D1 1-TA7003-BX
4-P Combination, Wheel Dia 915 mm (HW), GR : 20/91
Motor Continuous Current : 415 Amps.
Motor Maximum Current : 750 Amps.
Motor Maximum Voltage : 900 Volts.
Speed Vs TE (100% FF)
CONT.T.E (5800 KG)
T.R ON 1 IN 60 GRADIENT
T.R ON 1 IN 100 GRADIENT
T.R.ON LEVEL TRACK
CONT.SPEED (42.8 KPH)
T.E.(KGs)
SPEED (KPH)-------
16000
15000
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
0
10
20
30
40
50
60
70
80
90
100

Fig 15.24