STARTING CIRCUIT & RADIATOR FAN DRIVE

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OBJECTIVES

- Staring Circuit—Introdction
- Pre-requirement for starting a loco
- Main Components for staring
- Starting and Running Circuits
- Radiator Fan Introduction
- RF Working
- RF Control
- RF Schematic Diagram

STARTING CIRCUIT

This is an electrical circuit designed to help crank the locomotive engine by one or two electric motors powered by the starting batteries.

[Electric motor(s) are originally dc generator(s) but during cranking, work as dc motor(s) for being the same construction.]

Starting Circuit also helps give power to Fuel Pump Motor for fuel supply , Crankcase Exhauster Motor for creating vacuum inside the Crankcase and make ready the Governor for controlling fuel supply according to load and notch.

STARTING CIRCUIT

For safety consideration ,the Starting Circuit is designed such that

(i) If LOP is not building up sufficiently the cranking will not be continued and the Gov. will make the loco shut down

(ii) If Water quantity in expansion tanks of the loco or LOP become insufficient at any moment the Gov. will make the loco shut down

The starting circuit also help stopping the loco.

PRE-REQUIREMENT FOR STARTING A LOCO

1. Sufficient FOP created by Fuel Pump Motor of 1.5 HP,1725 RPM driven by Batt./ Aux.Gen and located near Expresser room :

2.45 -3.16 Kg/cm2.(35-45 psi)

PRE-REQUIREMENT FOR STARTING A LOCO

2. Sufficient LOP Created by Lube oil pump driven by Extension shaft gear :

To monitor this a OPS is fitted on the wall of the front panel or in the Woodward Gov. and this is set at

1.6 Kg/cm2 (Pick up) and

1.3 Kg/m2 (Drop)}

PRE-REQUIREMENT FOR STARTING A LOCO

3. Sufficient water quantity : (In WDM2,capacity=1210 L and Water level=14”)

Water level should be higher than 1” in the Expansion Tank.

PRE-REQUIREMENT FOR STARTING A LOCO

4. Fast exhaustion of burnt gas from crankcase lube oil sump

(i) For efficient return of lube oil into the sump from different components coming across lube oil system.

(ii) For Lubricating the gap between liners and pistons of cylinders by splashing.

(iii) For protection against bursting of the Crankcase sump.

For this,1" to 1½" water vacuum is created in the Crankcase sump by a compound dc motor of 0.33 HP,3000 RPM.

PRE-REQUIREMENT FOR STARTING A LOCO

5.Sufficient Hydraulic Pressure to run the governor : in Woodward gov. – 100 psi created by camshaft gear.

(Control Shaft controls mechanically the movements of FIP racks of all cylinders of the loco. And , the movements of this control shaft is controlled by the Hydraulic Pressure through Gov. Linkages.)

MAIN COMPONENTS FOR STARING

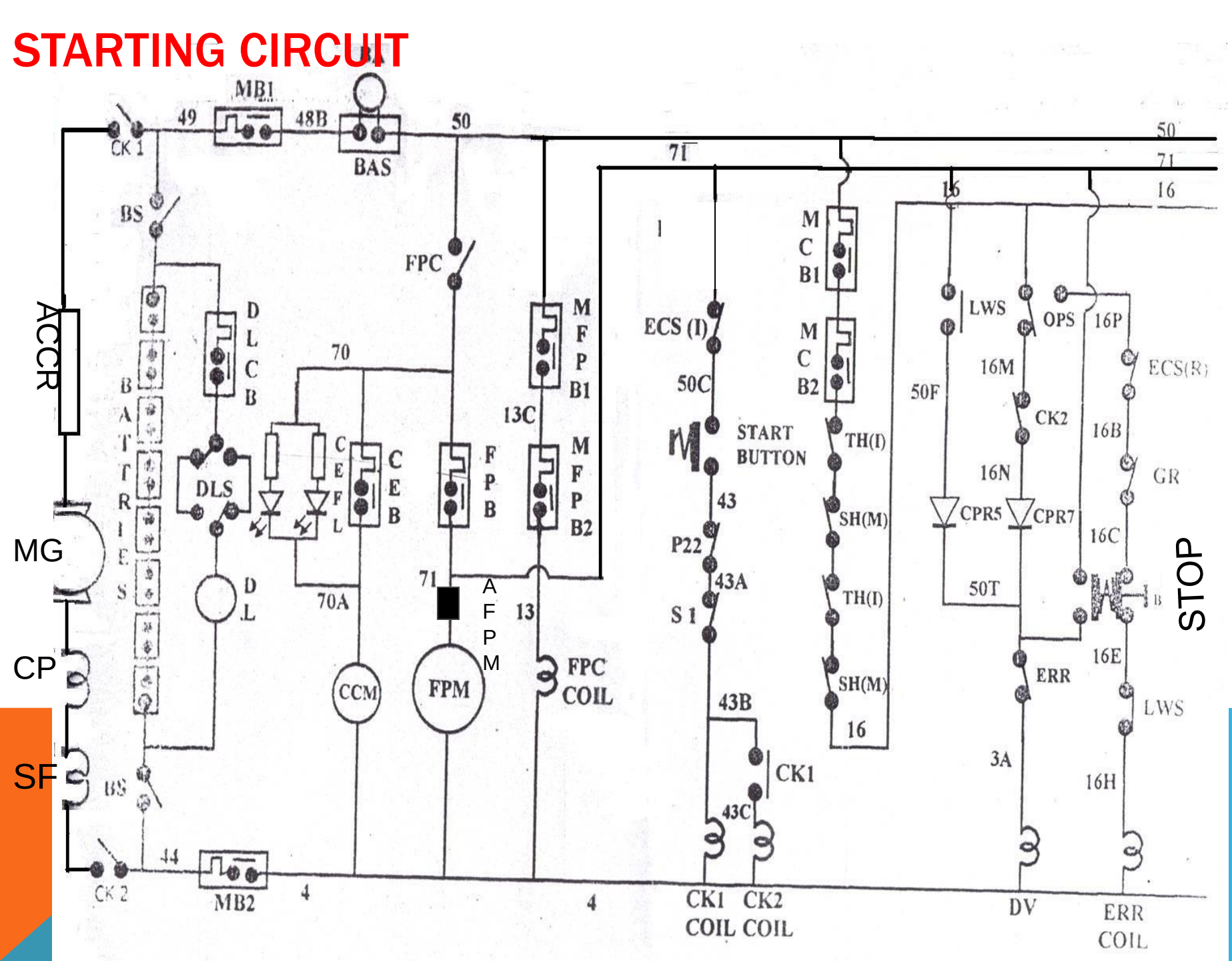
Batteries-08 Nos. batteries connected in series (V≈ 2.24×4×8 ≈72 V)

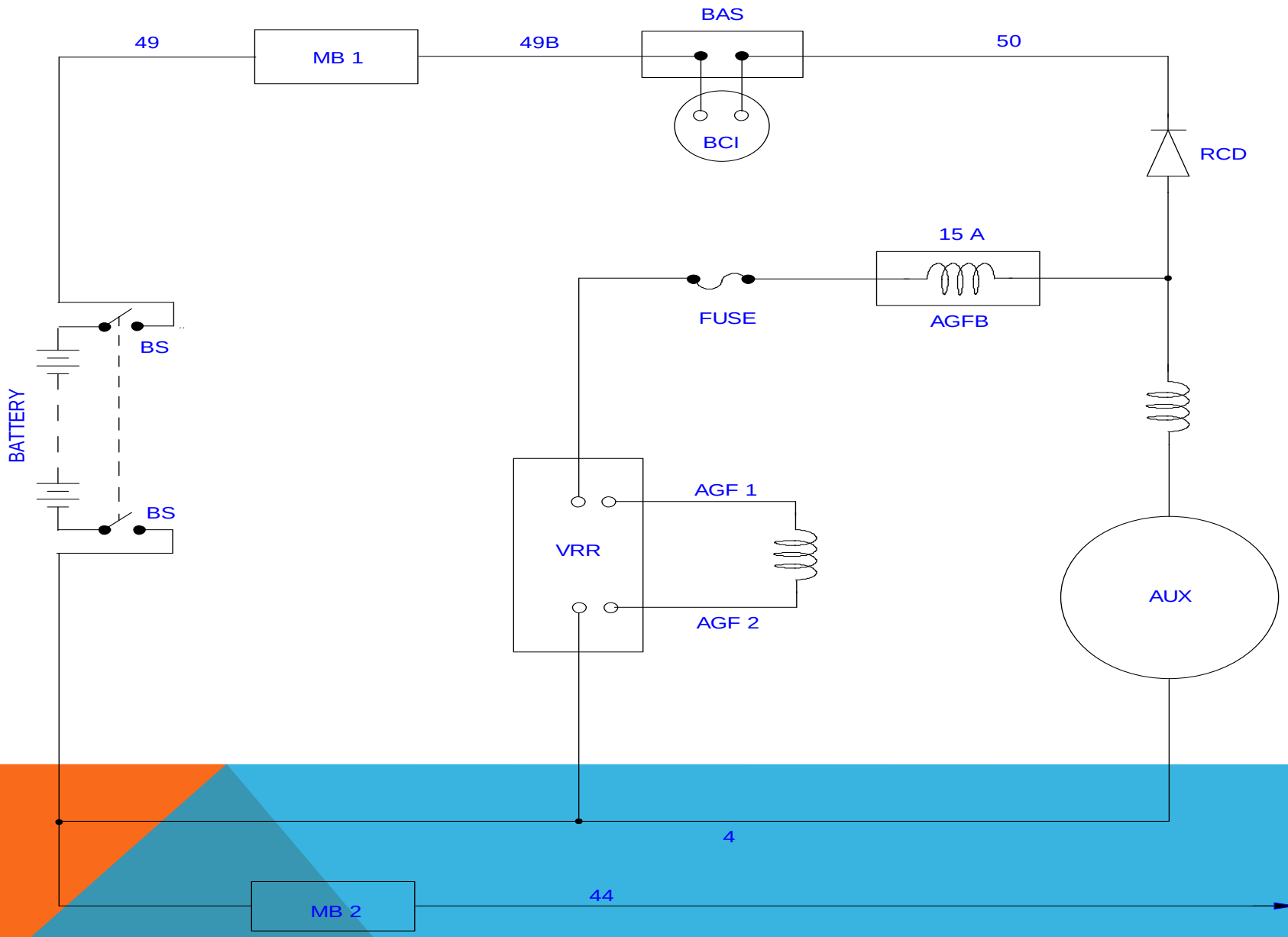
Battery Knife Switch- Fitted in Nose Compartment .

Circuit Breakers-

MB1	Batt. Breaker	200 A		MFPB2	Main Fuel Pump Breaker-2	30A
MB2	Master control Breaker	150 A		MCB1	Main Control Breaker-1	15A
CEB	Crankcase Exh.Breaker	15 A		MCB2	Main Control Breaker-2	15A
FPB	Fuel Pump	30A		AGFB	Aux. Gen. Field Breaker	15A
MFPB 1	Main Fuel Pump Breaker-1	30 A		DLCB	Dome Light CB	15/30A

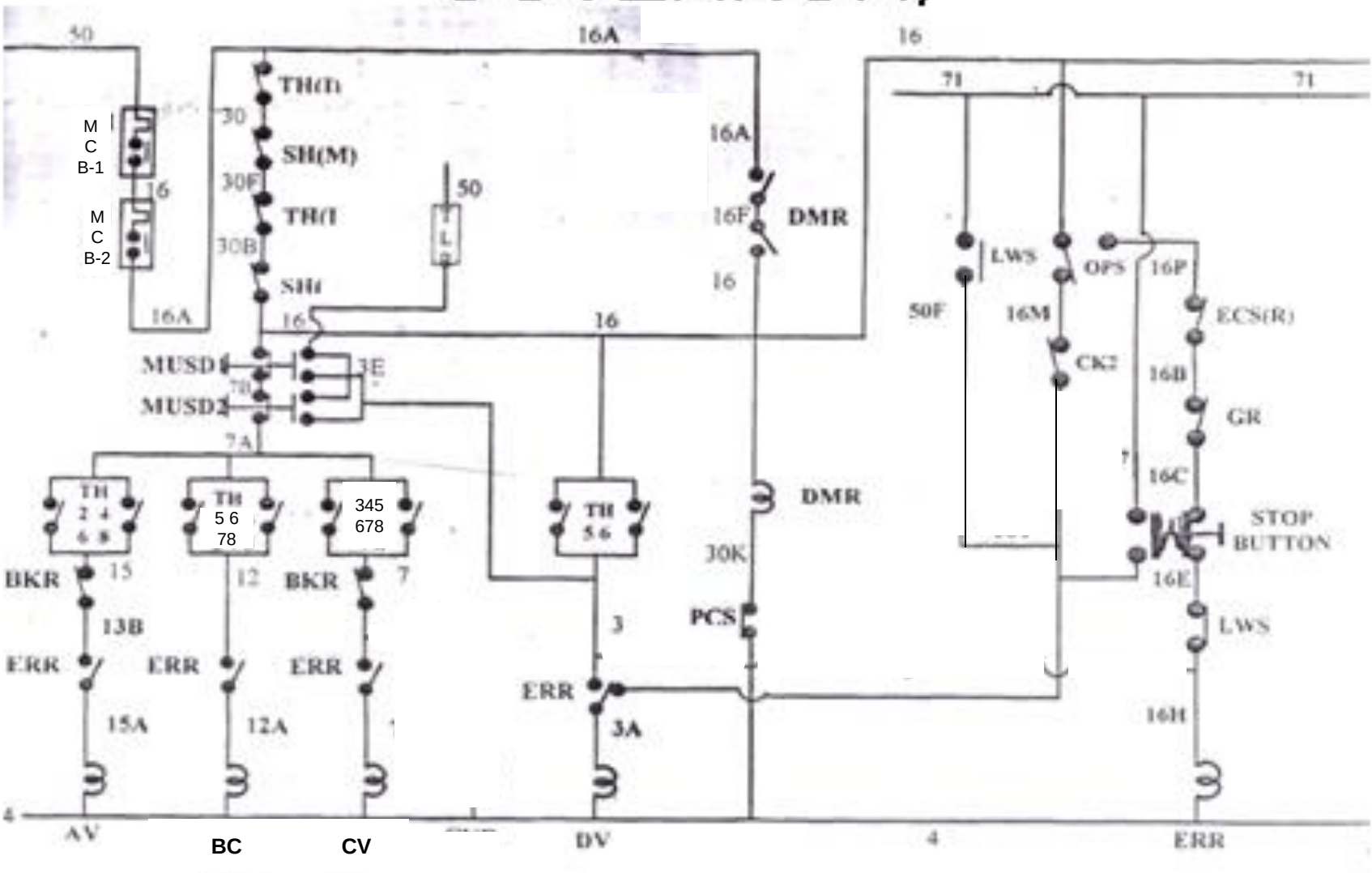
STARTING CIRCUIT





BATTERY CHARGING CIRCUIT OF WDM 2 LOCOMOTIVE

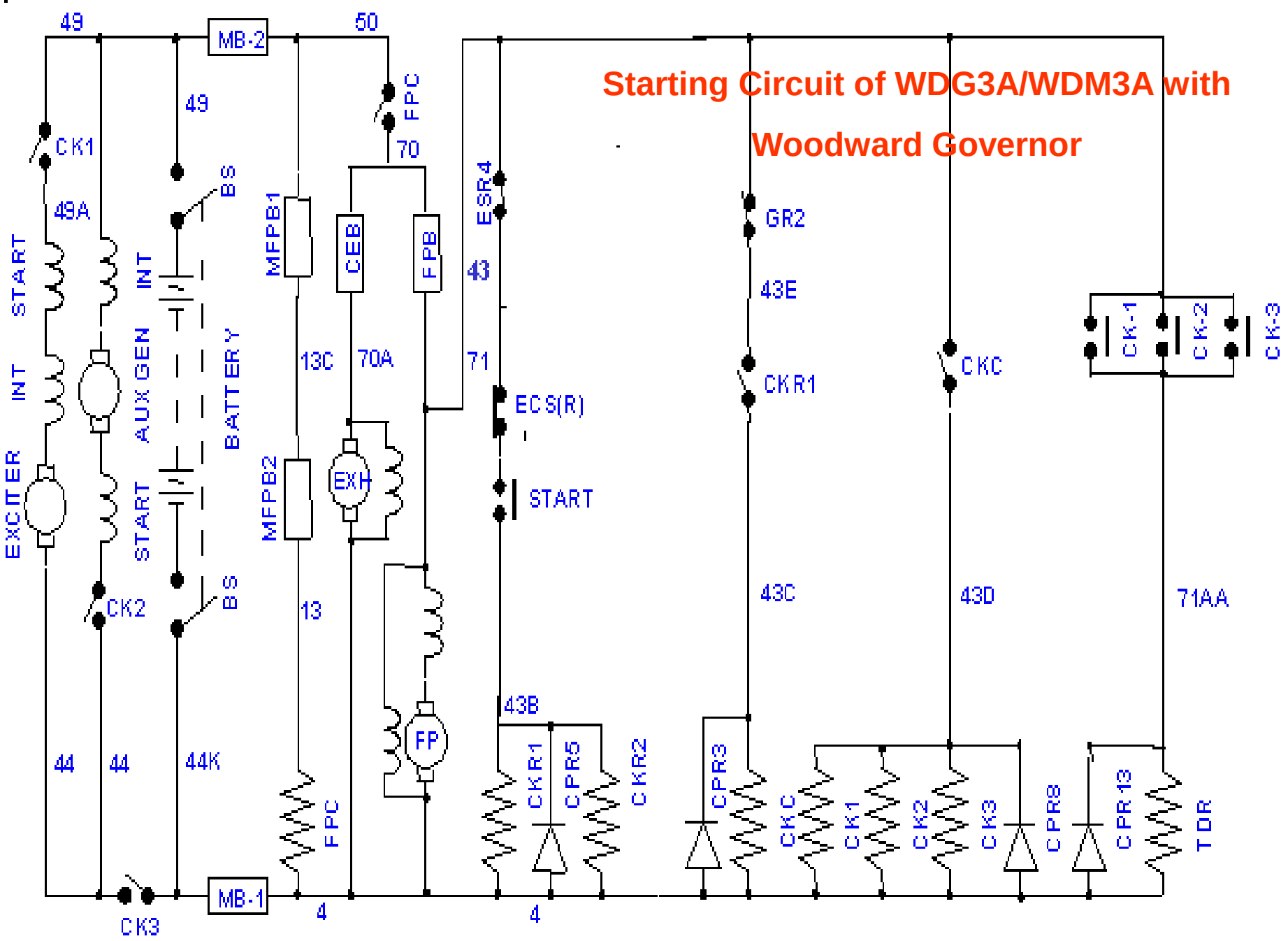
TH DMR CIRCUIT (WW GOVERNOR)



Typical Engine Speed Chart

Notches	SV-A	SV-B	SV-C	SV-D
Stop				*
Idle/1				
2	*			
3			*	
4	*		*	
5		*	*	*
6	*	*	*	*
7		*	*	
8	*	*	*	

Starting Circuit of WDG3A/WDM3A with Woodward Governor



RADIATORFAN INTRODUCTION

The temperature of any component of a locomotive should not exceed beyond the prescribed limit for securing its performance .

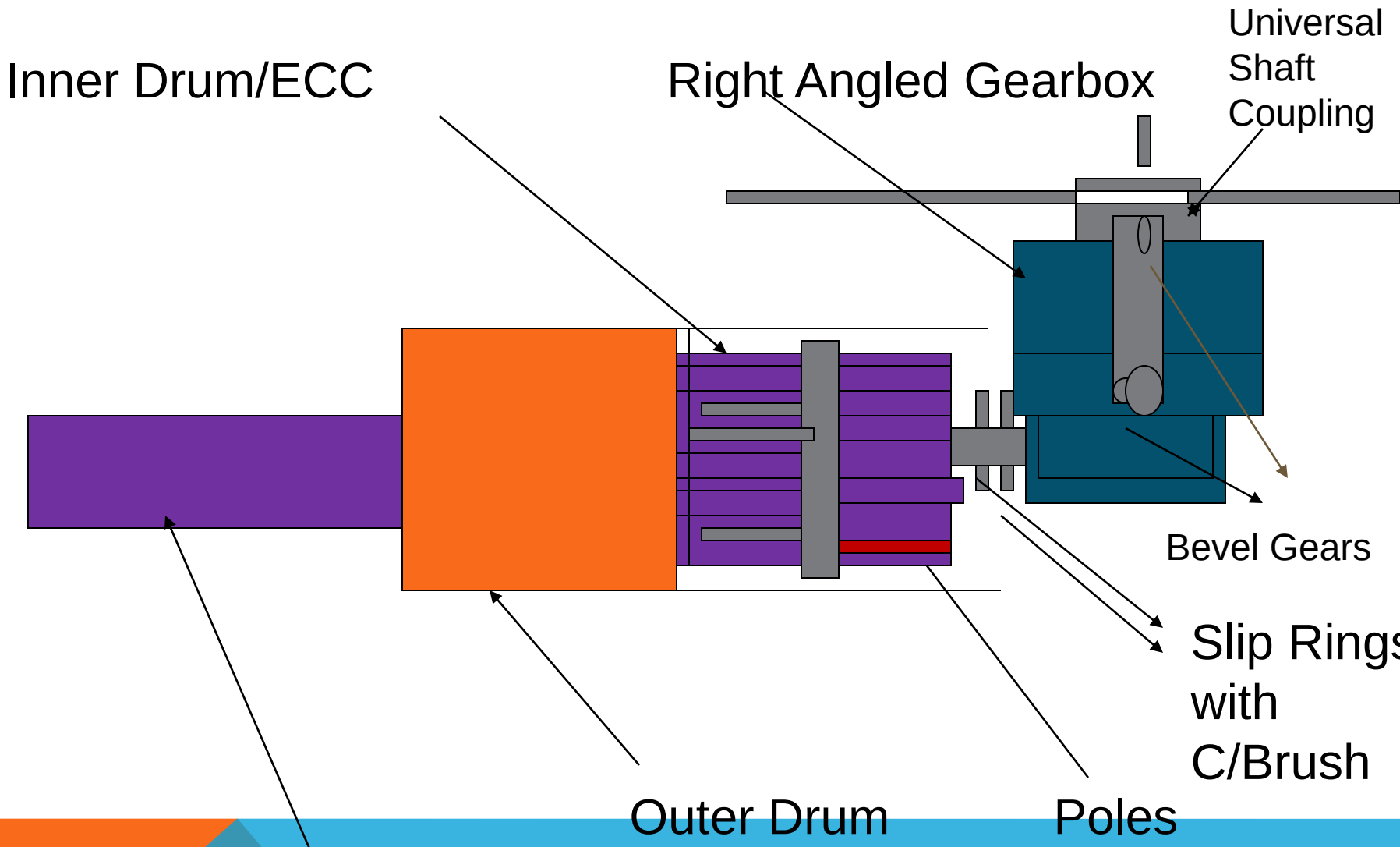
For this the loco is equipped with water cooling system.

RADIATOR FAN INTRODUCTION

Radiator fan is a part of this cooling system and this is located in the Radiator room. It consists of –

1. 6 heavy and thick wings having their profile such that the atmospheric air is attracted from the either side of the radiator room via radiator cores and thrown away towards upward.

2. Hence it helps cool the radiator cores ,Lube oil cooler etc.by convection.



Schematic Diagramme

RADIATOR FAN WORKING

Actually the power of Crankshaft transmits to the Radiator fan as follow:

Crank Shaft → Extension shaft no.2 → Outer Drum→ Inner Drum(ECC)→ (With some slip) (GR=1:1.312)

Horizontal Bevel Gear →Vertical Bevel Gear →Radiator Fan

RADIATOR FAN WORKING

When ECC energizes an electro magnetic torque is produced which resists the relative speed between the inner drum and outer drum . This torque (also called clutching torque) is caused by the interaction between the Magnetic field produced by the ECC with Eddy current produced on the inner surface of the outer drum.

RADIATOR FAN WORKING

Hence from previous slide,

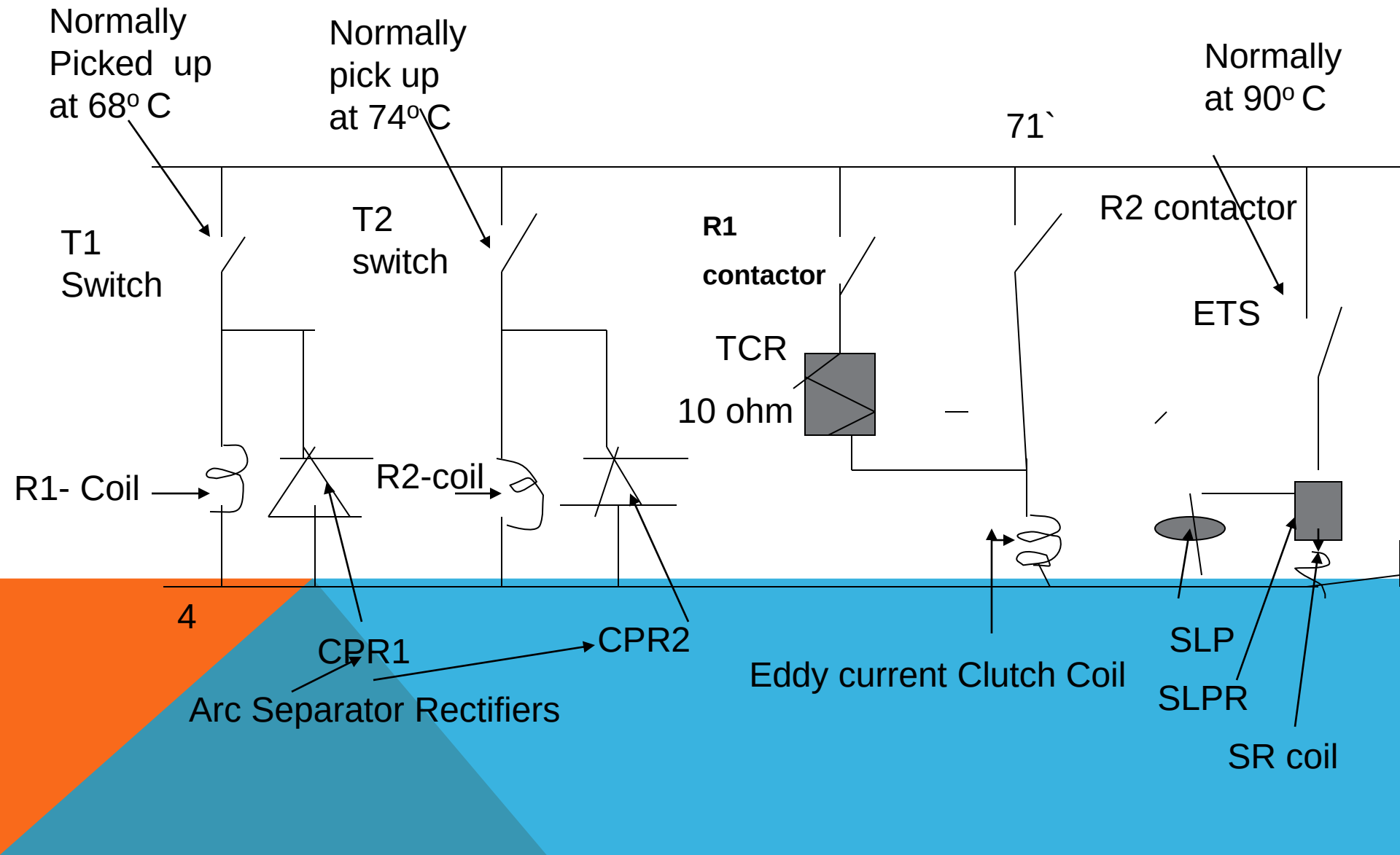
$$T \propto \Phi \times I_{Eddy}$$

STARTING& CONTROL

When crankshaft is running , the Radiator fan assembly can be started and controlled by controlling DC current being supplied from auxiliary generator to ECC. This is done by -

1. Temperature Sensitive Switches (Thermisters} ETS1/ ETS2 which operate as soon as the water temperature reaches the set values.
2. Emergency Switch fitted on the front panel in the Driver's cab room.

Schematic diagram



Thermisters	Pick up temperature in deg.C	Drop temperature in deg.C
ETS1/T1 (Speed=840 rpm)	68	65
ETS2/T2 (Speed=1200 RPM)	74	71
ETS3/T3 (For Safety Purpose)	90	87

THANK YOU