

Instruction No. TI/IN/0026	Effective from 23.09.2010	Protection scheme & relay setting guideline for 25kV, ac traction sub-station provided with 30MVA capacity of traction transformers.
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Traction Installation Directorate



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**Government of India
Ministry of Railways**

Instruction No. : TI/IN/0026

FOR

**Protection scheme & Relay setting guideline for
25 kV, ac traction sub-station provided
with 30MVA traction transformers**

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ISSUED BY

**Traction Installation Directorate
Research Designs and Standards Organization (Ministry of Railways)
Manak Nagar, Lucknow – 226011**

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1.0 Introduction

In order to meet the increased traction power requirement arising due to higher train density, train loads and speeds, RDSO issued technical specification number TI/SPC/PSI/30TRN/2070 (10/2007) for 30 MVA traction power transformers.

The comparison of 21.6 MVA & 30 MVA transformers is as under.

Transformer Rating (12.5% impedance)	Rated current in Amp	Prospective maximum fault current (neglecting source / earth resistance) at 25 kV bus
21.6 MVA (ONAN) / 30 MVA (ONAF)	800/ 1111	6.4 kA
30 MVA (ONAN) / 42 MVA (ONAF)	1111/ 1555	8.9 kA

Existing protection scheme (RDSO specification ETI/PSI/65(1/97)) and relay setting guide lines for transformer protection (issued vide letter Nos.ETI/SS/7 dated 22 April 1988) and ACTM relevant Para's were all based on 21.6 MVA traction power transformers.

This instruction now proposes to define protection scheme for TSS provided with 30 MVA traction transformers to provide.

- (i) Optimum utilization of overload capacity of the traction transformer
- (ii) Improvements in relay protection coordination.

1.1 Utilization of overload capacity of the traction transformer

1.1.1 The relay setting guidelines and protection relays provided as per old RDSO specification ETI/PSI/65(1/97) at 25 kV ac TSS does not allow to utilize the rated over load capacity of the traction transformer over 150% of transformer capacity while traction power transformers are designed to deliver 50% over load for 15 minutes and 100% over load for 5 minutes. The current setting of IDMT over current relay as per old specifications is adjusted at 150% of transformer rating i.e. above 150% of transformer loading it executes trip command to transformer CBs in around 3-4 second.

1.1.2 Moreover in the existing traction sub-stations provided with 21.6 MVA traction transformers no protective relays are provided to protect the transformer against over loading between 100 to 150 % of transformer rated load and the traction transformer is protected by only winding and oil temperature sensing relays provided with transformer tank.

1.1.3 In order to utilize the permissible over load rating of traction transformer between 150 to 200 % and protection against over load between 100 to 150%, three stage definite time OCR with independent setting of current and time for each stage is essential.

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1.2 Improvements in relay protection coordination

1.2.1 The static type transformer protection relays (IDMT over current on HV & LV sides) as per earlier RDSO specification ETI/PSI/65(1/97) does not have current and TMS settings in fine steps.

1.2.2 This sometimes results in to tripping of HV, LV or both side breakers for some faults on OHE. Moreover there is no coordination between HV & LV side IDMT over current relays (both are set at 150 %) which sometime results in tripping of HV breaker which has to be reclosed only after manual resetting of the Inter trip relay (ITR) at TSS thereby affecting TSS supply.

1.2.3 In order to utilize the rated over load capacity of traction transformer by provision of additional definite time over current relays for over load protection an improvement in relay protection coordination is essential.

1.2.4 The fine steps and better coordination in setting parameters/zones amongst all relays provided at TSS can only be achieved by using more precision numerical type protection relays having fine steps of setting.

1.2.5 Advanced numerical protection relays for transformer (IDMT OCR, Definite time OCR, REF and Differential) have already been developed and being provided on IR as per new specification TI/SPC/PSI/PROTCT/6070(9/08).

2.0 Protection scheme at 25 kV TSS with 30 MVA traction transformer

2.1 The new specification no. TI/SPC/PSI/PROTCT/6070(9/08) for control and relay panel with numerical type relays for traction transformer protection has already been issued to Zonal Railways. Which also covers the protection requirements of 30 MVA traction transformer permitting utilization of the over load capacity of traction transformer.

2.2 It is advised to provide numerical relays & control and relay panels as per RDSO specification no. TI/SPC/PSI/PROTCT/6070(9/08) with 30 MVA traction transformers.

2.3 The relay setting guide lines for all the numerical type protection relays of above specification have been circulated by RDSO vide Technical Instruction No. TI/IN/0022 (2/10) which should be followed. The procedure for setting different parameters of relays shall be according to manufacturer's instruction manual, field requirement and actual equipment provided at TSS.

2.4 Setting guidelines issued vide RDSO letter No. TI/PSI/PROTCT/STATIC/07 dated 23-04-2007 for feeder protection shall continue to be followed. At present no additional protection for overloading of feeder is being proposed because it is assumed that at any time only one transformer is in service and feeding the up and down lines on both side of IOL, hence the

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total current will be divided in four circuits and current in each circuit will be approximately 280 A in normal case and 560 A under maximum over loading (200%) of transformer, which is below the continuous rated current of catenary and contact wire (65 sq mm catenary & 107 sq mm contact wire). However during some unbalanced loading conditions or power block of any one line of any sub-sector within feeding zone of TSS, especially close to TSS, the total load current may flow in one line of sub-sector under power block, it may be more than the rated current of OHE. The policy of overload protection of OHE may be reviewed by RDSO based on the suggestions and experience generated by Railways in due course of time.

- 2.5 The 25 kV side CT are provided as per RDSO Spec No. ETI/PSI/90 (6/95) with A&C 1 to 7 where in CT Ratios of 750/5 and 1500/5 are available. It is recommended to use 1500/5 ratio in case of 30 MVA transformers as normal rated (permissible load) current are much higher than 21.6 MVA transformers.
- 2.6 The relay setting calculations of traction transformer and feeder protection relays should be done considering the actual parameters of given below equipment:
- Actual fault level at TSS.
 - Bushing CTs ratio of 30 MVA transformers.
 - CT ratio of HV and LV side.
 - PT ratio.
 - OHE configuration.
 - Rating of traction transformer.
- 2.7 The transformer specification stipulates use of ONAF mode for 40 MVA output however the recommended settings of Definite time OCR elements for traction transformer protection shall not permit the operation of 30 MVA traction transformer in ONAF mode i.e. 40 MVA continuously. Hence during ONAF mode of operation, the setting of stage-1 definite time OCR on LV and HV side shall have to be reviewed.