



सत्यमेव जयते

**GOVERNMENT OF INDIA  
MINISTRY OF RAILWAYS**

**REPORT  
ON  
OPENING OF DEVELOPMENT  
OF  
3-PHASE LOCO EQUIPMENT  
THROUGH NON-ToT SUPPLIERS  
OVER  
INDIAN RAILWAYS**

**Report No. RDSO/2016/EL/ IR/0172**

**August' 2016**

**RESEARCH DESIGNS AND STANDARDS ORGANISATION  
MANAKNAGAR, LUCKNOW – 226 011**





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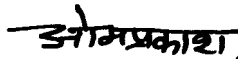
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**August' 2016**

  
(O.P. Kesari) 03.8.16  
EDSE/Co-Ord.

  
(B.B. Singh) 03.8.16  
CEE/CLW

  
(A.K. Chattopadhyay)  
CELE/ER

29/6/16  
2406  
cc: Dt  
Office Dt

भारत सरकार GOVERNMENT OF INDIA  
रेलमंत्रालय MINISTRY OF RAILWAYS  
(रेलवे बोर्ड RAILWAY BOARD)

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No. 2006/Elect(TRS)/441/8Pt

General Manager

Chittaranjan Locomotive Works,  
CHITTARANJAN

ED/EL New Delhi, Dated : 27.06.2016

**Sub: Opening of development of 3 phase loco equipment through Non ToT suppliers.**

**Ref :-** (i) CLW letter No. C-D&D/T/24 dated 02.05.2016  
(ii) CLW's letter No. C-D&D/T/24 dtd. 06.03.2013  
(iii) RDSO letter No. EL/5.5/1/IGBT dated 03.06.2016  
(iv) RDSO letter No. EL/11.5.5/1/IGBT dated 09.07.2014

CLW vide letter under ref(i) & (ii) (copy enclosed for ready reference) had submitted a proposal to relax the conditions of 'procurement of IGBT traction converters only through ToT partners' and open it to non-ToT suppliers also.

RDSO vide letters under ref (iii) & (iv), had submitted its recommendations, enclosed as annexure, which are self explanatory.

The proposal has been examined in this office and Board (ML) has approved the following:

- (i) A committee comprising EDSE(Co-ord)/RDSO (Convener), CEE/CLW & CELE/ER is formed to deliberate on the following:
  - a. Examine the issue of Transfer of Technology and the associated process for inspection and development of vendors for IGBT based Traction Converter, IGBT based Auxiliary Converter, TCN compliant VCU and 3-phase loco Transformer equipped with Hotel load twin winding, in the light of the comments offered by CLW & RDSO.
  - b. Suggest any changes keeping in view the status of vendors approved so far as ToT partners and those to be developed without going through the process of ToT.
- (ii) Based on the recommendations of the committee, the issue of ToT may be dealt with by GM/CLW and Board apprised.

It is advised to take necessary action accordingly.

(A.K.Goswami)  
Dir. Elect. Engg. (RS)  
Railway Board

e-mail : [deers@rb.railnet.gov.in](mailto:deers@rb.railnet.gov.in)

Copy to:

EDSE(Co-ord)/RDSO: For kind information and necessary action please.

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## Abbreviations

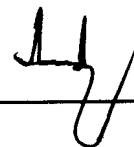
The following abbreviations are used in this Specification:

Abbreviation	Full Name
ABB	Asea Brown Boveri Limited
BUR	Auxiliary Converter
BHEL	Bharat Heavy Electricals Limited
BTIL	Bombardier Transportation India Limited
CGL	Crompton Greaves Limited
CLW	Chittaranjan Locomotive Works
ELS	Electric Loco Shed
GM	General Manager
GTO	Gate Turn-off Thyristor
IR	Indian Railways
ISO	The International Organization for Standardization
LoA	Letter of Acceptance
MICAS	MICrocomputer Automation System
MoU	Memorandum of Understanding
OHE	Over Head Equipment
OEM	Original Equipment Manufacturer
P.O.	Purchase Order
QAP	Quality Assurance Plan
RDSO	Research Designs and Standards Organization
RTGS	Real Time Gross Settlement
SID	Source Identified for Development
SR	Traction Converter
STR	Schedule of Technical Requirement
ToT	Transfer of Technology
TCN	Train Communication Network
VCU	Vehicle Control Electronics

## CHAPTER - 1

### INTRODUCTION

1. The Indian Railways procured 3-Phase AC electric locomotives with GTO (Gate Turn-off Thyristor) based drive system from M/s ABB, Switzerland on the basis of Transfer of Technology (ToT) with GTO based Traction converter, Auxiliary converter and MICAS based Vehicle Control Unit (VCU) in 1993. As per the agreement the manufacturing of locomotives started in India at CLW, Chittaranjan since 1995. The product mix of three phase locomotive consists of WAP-5, WAP-7, WAG-9 and WAG-9H types.
2. At present, following items of three phase locomotive are developed through a process of Transfer of Technology (ToT):
  - (i) Traction Converter;
  - (ii) Auxiliary Converter;
  - (iii) Vehicle Control Units;
  - (iv) Transformer; and
  - (v) Traction Motor.
3. The manufacturers who get the Transfer of Technology (ToT) are called ToT partners. Only ToT partners can supply above items and a new manufacturer needs to follow the due process for obtaining the ToT as per procedure explained in Chapter-2.
4. In order to widen the vendor base, RDSO and CLW have represented several times in past to remove the system of ToT and follow the normal process of development of these items as being done for other equipments of three phase locomotives. Letters of CLW, RDSO and Railway Board in this regard are enclosed as Annexure -1.
5. To examine all the issues connected with opening of development of 3-phase loco equipments through Non-ToT suppliers, Railway Board vide letter no. 2006/Elect(TRS)/441/8Pt.dtd. 27.06.2016 constituted a committee as under:
  - (i) Sh. O. P. Kesari, EDSE (Co-ord)/RDSO – (Convener)
  - (ii) Sh. B.B. Singh, CEE/CLW – Member
  - (iii) Sh. A.K. Chattopadhyay, CELE/ER– Member



6. The committee has following terms of references:

- a. Examine the issue of Transfer of Technology and the associated process for inspection and development of vendors for IGBT based Traction Converter, IGBT based Auxiliary Converter, TCN compliant VCU and 3-phase loco Transformer equipped with Hotel load twin winding, in the light of the comments offered by CLW & RDSO.
- b. Suggest any changes keeping in view the status of vendors approved so far as ToT partners and those to be developed without going through the process of ToT.

7. In light of above the committee deliberated as per Railway Board's letter no. 2006/Elect(TRS)/441/8Pt. dtd. 27.06.2016 which are detailed in Chapter 2, 3, 4 and 5.

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## CHAPTER - 2

### EXISTING SYSTEM OF TRANSFER OF TECHNOLOGY (ToT)

#### 1. Introduction

On 23rd July 1993, a historic decision was taken by Indian Railways to embrace Three Phase Drive Propulsion for its new builds of electric rolling stocks, by signing three separate contracts with the then ABB (Switzerland) – Presently Bombardier Transportation. The supply contract consisted of purchase of 10 high speed passenger locomotives of WAP5 class with speed potential of up to 160 km/h and 20 numbers of 6000 HP freight locomotives, of which, later 16 were to be supplied in SKD form to be assembled at CLW with the presence and assistance of ABB engineers. The Transfer of Technology (ToT) contract included transfer of know how to Indian Railways through documents and training, for both ABB and Non-ABB products. The third contract was for an extended warranty of 05 years for maintaining the 10 passenger and 20 freight locomotives in Indian Railways system.

#### 2. Transfer of technology of critical electrical items

Other than the Vehicle Control Software, the five loco equipment, viz., Traction Converter, Auxiliary Converter, Control Electronics, Transformer & Traction Motors are the major equipment. Initially these 05 items constitute more than 50% of the locomotive cost. For these 05 items, as per the ToT contract, full know how for their manufacturing and testing was to be transferred.

For the items other than Traction Motor, CLW was not identified as a manufacturing unit and balance four items were to be made by Indian Industry Partners. On the other hand, ABB would transfer the technology only to Indian Railways.

Railway Board formed a committee of SAG officers from Stores, Electrical and Finance, also involving units like RDSO and CLW in order to assess and identify most promising industry partners (who were later known as ToT Partner) for the above 05 items. CLW was already identified as one of the source for manufacturing traction motors. The committee was to make physical assessment of all aspects and finally recommend a list of Industries, which would then be approved by Railway Board. In order to make the participation from Industries really genuine



and serious, a ToT fee was charged (to be paid in installments) for getting the know-how once they are selected. The ToT fee for various items is given in table 3.1 of Chapter-3. The purpose of ToT fee was to ensure earnestness and commitment in the participation for development and manufacturing. After a rigorous exercise, Indian Industry partners were identified. The initial list identified for ToT partner for participation at that time is given in Table-2.1.

Table – 2.1

ToT Partner	Identified for the equipments				
	Traction Converter	Auxiliary Converter	Control Electronics	Transformer	Traction Motor
BHEL	Yes	Yes	Yes	Yes	Yes
BTIL	Yes	Yes	Yes	Yes	No
CGL	Yes	Yes	Yes	Yes	Yes
NELCO	Yes	Yes	Yes	No	No
KEC	Yes	Yes	Yes	No	Yes
EMCO	No	No	No	Yes	No
PRECISION	No	No	Yes	No	No

### 3. Present status of ToT

Over a period of time, the list got changed as some partners deserted and a few new ones came in and CLW adopted the following procedure for development of these items through ToT:

- The firm desiring to be a ToT partner approaches CLW or Railway Board for ToT.
- The Schedule of Technical Requirements (STR) prepared by CLW for ToT is sent to the firm for compliance of the same.
- After getting firm's compliance on the STR, the three members Committee of PHOD (CEE/CLW, FA&CAO/CLW & COS/CLW) inspect the firm for assessment of capacity to produce the item and compliance of STR.
- Assessment report of committee of PHODs duly endorsed by GM/CLW is sent to Railway Board for approval.


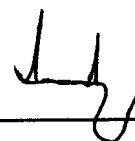
- (v) After getting Railway Board's approval, ToT agreement between CLW and firm is signed. Firm is advised to pay ToT fee in 3 installments.
- (vi) In first installment, the firm is asked to pay 50% of ToT fee.
- (vii) After getting first installment of ToT fee, requisite ToT documents are handed over to the firm and the firm is asked to submit 2nd installment which is 30% of the total ToT fee.
- (viii) The 3rd installment which is 20% of total ToT fee is paid by the firm at the time of placement of the 1<sup>st</sup> order.

However, with time several firms came forward to develop these items and after completion of the ToT formalities their names were included in the CLW's approved vendor list. At present the status of these items in the CLW's approved vendor list is as follows for GTO based converters, traction motors & transformers:

Table – 2.2

SN	Description	ToT Partners as per Approved Vendor List of CLW
1.	Traction Converter (being followed for GTO based traction converter)	Part-1: BTIL, CGL, BHEL
2.	Auxiliary Converter (being followed for GTO based auxiliary converter)	Part-1: BTIL, CGL, BHEL Part-2: HIRECT, AAL
3.	Traction Motor	Part-1: BHEL, CGL Part-2: Saini Electricals
4.	Main Transformer for WAG-9 Loco (6531 KVA)	Part-1: BTIL, BHEL, CGL, ABB, EMCO Part-2: High Volt, HIRECT
5.	Main Transformer for WAP-5/WAP-7 (7475/7775 KVA)	Part-1: BTIL, BHEL, CGL, ABB, Part-2: High Volt, Stesalit
6.	Central Electronics	Part-1: BTIL, CGL, BHEL

The details of the supplies of different ToT partners is given in Annexure-4.

#### 4. Development of IGBT based converters

Due to obsolescence of GTO technology, Indian Railways decided to migrate to the state of the art IGBT based traction and auxiliary converters. Vide RB letter No. 2003/Elect(Dev)/440/18/17 dated 05.09.2004 (Annexure-2), it was decided that the development of IGBT based traction and auxiliary converter shall also be done through the existing ToT partners. The firms who were not ToT partners were advised to comply the ToT formalities as stated in para-3 of this chapter before placement of formal developmental order.

4.1 Requirement of ToT from the prospective IGBT based converters suppliers is mandatory because the integration of converters with existing VCU, Transformer and Traction Motor could only be done with sharing of details of functionalities of these equipments and the loco as a whole. As there was no modification in the existing VCU, Transformer and Traction Motor, the similarity of dynamics of these equipments with developed converters is only possible with the complete knowledge of locomotive with the suppliers. Hence, transfer of technology was the only way to achieve it.

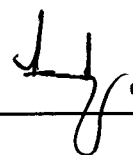
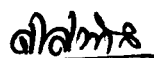
4.2 Thus, the developmental purchase orders for IGBT based traction and auxiliary converters were placed as per the following table in the beginning:

Table – 2.4

S N	Item	Firm's Name	T. Case/ P.O No./ LoA No.	Order Qty.	Remarks
1	SR	BHEL	P.O.70/2006/1114/00044 dt.02.1.08	05 sets	-
		NELCO	P.O.70/2006/1114/00046 Dt.11.3.08	02 sets	Later on the business activities were taken over by CGL.
		BTIL	P.O.70/2006/1114/049. Dt.25/04/2008.	02 sets	-
		ABB	P.O.70/2006/1114/00056 Dt. 23/06/2008.	01 set	Formal order was released after the firm completed the ToT formalities.
2	BUR	AAL	P.O 70/2006/1115/ 0032 dt.29.9.07	04 sets	-
		HIND	P.O 70/2006/1115/0040 dt.02.11.07	01 set	-
		NELCO	P.O. 70/2006/1115/ /0041 dt.19.11.07	01 set	Later on the business activities were taken over by CGL.
		BHEL	P.O.70/2006/1115//0047 dt.14.3.08	03 sets	-

		ABB	P.O.70/2006/1115/0051dt.20.6.08	01 set	Formal order was released after the firm completed the ToT formalities.
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4.3 The committee has observed that in CLW the placement of purchase order for IGBT based SR & BUR is still being done based on the eligibility criteria basis. As per the eligibility criteria being followed by CLW the bulk order are placed on ToT partners for both IGBT based traction and auxiliary converter. It is worthwhile to mention that as per the present system, all the ToT partner are at the same status as far as the placement of orders is concerned for IGBT based traction/auxiliary converters.



## CHAPTER- 3

### EVALUATION OF EXISTING SYSTEM OF ToT

1. Transfer of Technology (ToT), is the process of transferring skills, knowledge, technologies, methods of manufacturing, samples of manufacturing and facilities to other institutions to ensure that scientific and technological developments are accessible to a wider range of users who can then further develop and exploit the technology into new products, processes, applications, materials or services.
2. The acquisition and absorption of foreign technologies, and their further development, are complex processes that demand significant efforts from the acquirers. Several factors contribute to this complexity due to following:
  - i) The acquisition and mastery of technology are both costly and time-consuming.
  - ii) The acquired technologies often need to be adapted to local conditions.
  - iii) The technologies are not commodities that can be transferred as a complete ready-to-use set; they also contain tacit components that are not easily codified and transmitted in written documents, and require extensive learning efforts to be properly understood.

#### 3. ToT fee:

CLW used to charge ToT fee also at the time of technology transfer mainly to ensure firm commitment from the firms to develop the item after acquiring ToT from CLW. The ToT fee paid by the firm to CLW was recovered by the firm after material supply to CLW. As per Railway Board's letter no. 93/Elec. (TRS)/440/18 Pt. 1 dated 28.08.1995 (Annexure-3), ToT fees for development of the items is as given below:

Table – 3.1

SN	Item	ToT Fees
1.	Traction Converter	1.0 Crore
2.	Auxiliary Converter	15 Lakhs
3.	Vehicle Control Units	32 Lakhs
4.	Transformer	50 Lakhs
5.	Traction Motor	35 Lakhs

*Sub*

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#### 4. Relevance of ToT in present scenario

##### 4.1 Traction Converter, Auxiliary Converter & VCU:

Railway Board vide letter no. 2006/Elect (TRS)/441/8 PT.3 dated 27-01-2016, constituted a committee for proliferation of IGBT Technology in 3-phase loco. Based on the recommendation of the committee, Railway Board decided vide letter no.2006/Elect(TRS)441/8 Pt.3 dated 19-04-16 for procurement of IGBT based traction converters, auxiliary converters and VCU as a set known as propulsion system. Moreover, IR has already switched over to IGBT technology 100% and procurement of GTO based converters has been stopped. The existing ToT was applicable to GTO converters only. Since, IR has switched over to different technology (i.e. IGBT) coupled with TCN compliant VCU to be procured as propulsion set, the norms for ToT do not apply for development/proliferation of IGBT technology as propulsion set.

##### 4.2 Traction Transformer:

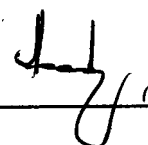
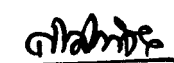
Similarly in traction transformer, (the originally procured with ToT) has been upgraded with following major modifications:

- (i) Twin winding of 622.5 KVA for each Hotel Load converter to feed train power supply
- (ii) Consequent upon modification in Hotel Load winding, Transformer capacity has also been upgraded to 7775 KVA as the earlier capacity of 7500 KVA was inadequate. And therefore, the earlier transformer has undergone major up-gradation to meet the new requirement and therefore ToT is not relevant.

##### 4.3 Traction Motor:

Rotors of traction motors type 6FRA6068 used for WAG9 locos have also been modified by having scheme-I/scheme-II (RDSO specification no. RDSO/2007/EL/ SPEC/0060, Rev-0 and specification no. RDSO/2007/EL/SPEC/0061, Rev-0). Stators of traction motors type 6FRA6068 have been modified as per modification sheet no. RDSO/2007/MS/0355 rev-02, which is a major design modification. Therefore presently traction motors of three phase locomotives have also gone under major change and therefore ToT is not relevant.

Railway Board vide letter no. 97/Elect (TRS)/113/4 Pt dated 02.06.08 (Annexure-6) has already dispense with the process of ToT for development of 3-Phase traction motor for WAG-9/WAP-7 locomotives.



Considering the above facts, it is noted that five items which were under the cover of ToT (Traction converter, Auxiliary converter, VCU, Transformer and traction motor) have undergone major modification/changes/up-gradations in capacity as explained above.

Therefore, the committee feels that ToT has no relevance in the present scenario for any of these 5 items covered under ToT.

#### 5. The changes in the existing procedure

The existing procedure of development of these five items has already been described in para-3 of Chapter-2. As already described in Para-4 above, the present system of development of ToT partners is not relevant due to up-gradation of technology / major design changes and thus there is a need to do away with the existing system and to formulate the new system of development of vendors. In the past years several proposals have been sent for dispensing with ToT. The details of these proposal letters are as under. All these letters are enclosed as Annexure-1.

SN	Letter reference	From	To
1.	DO letter No. C-D&D/T/14 dtd. 29.01.09	GM/CLW	ML
2.	C-D&D/T/24 dtd. 06.03.13	CEE/CLW	EDSE/RB & Sr. EDSE/RDSO
3.	EL/11.5.5/1/IGBT dtd. 09.07.14	Sr. EDSE/RDSO	Secretary (Elect.)/RB & CEE/CLW
4.	C-D&D/T/24 dtd. 01.10.14	CEE/CLW	Sr. EDSE/RDSO & Railway Board
5.	EL/11.5.5/1/IGBT dtd. 03.06.16	EDSE (Co-ord)/RDSO	Railway Board & CLW

It is also pertinent to note that these five items are not only the complex but also important equipment in the locomotive and require very high reliability of performance.

Expenditure of the firm on account of ToT fees is indirectly loaded on the cost of equipment and therefore levy of ToT fees is likely to increase the cost of the equipment to be supplied by the firm.

It is also pointed out that ToT agreement was signed in 1993 between ABB and IR. As per this ToT agreement, there is no restriction on IR after a lapse of 10 years, i.e. 2003 onwards to dispense with ToT contracts for further procurement.

## CHAPTER-4

### PROCEDURE ADOPTED FOR DEVELOPMENT OF ITEMS OTHER THAN ToT ITEMS

#### 1. Procedure being adopted in RDSO:

Electrical Directorate of RDSO has prepared Work Instruction for Development of Vendor (doc. no. EL-WI- 7.1-1) to lay down instructions for Vendor approval/Vendor registration (Multi Sourcing), Vendor List, Quality Audit of vendor registration, product development, and publishing expression of interest and creation/change/deletion/Change of controlling authority for equipment, item specification for items allotted to RDSO by Railway Board for Electrical Directorate.

(i) Vendor seeking registration for items applies for registration online through RDSO website [www.rdsso.indianrailways.gov.in](http://www.rdsso.indianrailways.gov.in). At the time of application, following documents are essential and is required to be submitted:

- QAP as per the standard format.
- Self compliance of the STR.
- Annexure to STR along with proof of ownership in the form of affidavit on Rs. 100/- Non Judicial Stamp Paper duly notarized.
- Copy of ISO certificate.
- Copy of Digital Certificate.
- Copy of latest Electricity bill.
- Copy of Factory license for SSI/NSIC.
- Copy of Ownership of the factory.
- Copy of the receipt of Bank about payment of charges through RTGS.
- Self compliance of specification (firm shall purchase specification(s) & drawings of the item from Online Purchase of Documents link on RDSO website).

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**(ii) Payment of registration charges:**

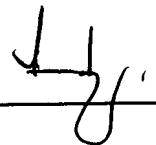
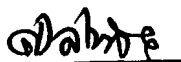
Registration fee for Fresh Registration is deposited through RTGS/NEFT to RDSO as per the guidelines given on e-payment to RDSO on Home page of website [www.RDSO.indianrailways.gov.in](http://www.RDSO.indianrailways.gov.in). The details of the fee are as under:

- (a) For Indian firms: Rs. 15000/- for Micro/ Small Enterprises and Rs. 25000/- for other than Micro/ Small Enterprises.
- (b) For Overseas Firms: \$1000.
- (iii) The application is scrutinized as per directive issued by ISO CELL Document No. "QO-D7.1-6 (latest version) for Vendor Application Processing.
- (iv) After the acceptance of application, nominated RDSO official(s) visit the firm's premises for STR verification and capability assessment.
- (v) In case the information is in line with the requirements and test results are satisfactory, the case is put up to Sr. EDSE for his approval.
- (vi) Fresh registration is normally given in Part-II only. Depending on the nature of item, Part-II status is given after ensuring:
  - Minimum Infrastructure and adherence to QAP
  - Satisfactory test of product prototype or initial or extended field trials,
- (vii) Depending upon the performance of certain quantity of equipment, vendor status is changed to Part-I (regular source) or can be delisted.

**2. Procedure being adopted in CLW:**

CLW has also prepared Work Instruction for Development of Vendor doc. No. CLW/MLAS/EL/WI/Rev.1 effective from 01.08.2015. The summary of this procedure includes the following steps in a short:

- (i) A new vendor, who has been considered for development of a product, either through a tender or outside the tender, will be assessed for its capacity cum capability and if found suitable, may be issued with an education order and vendor's name will be included in the "Master List of Approved Suppliers" as a Source Identified for Development (SID).



- (ii) The primary vendors are categorized either as Part – II (Developmental Source), or, Part – I (Regular Source) as per CLW work instruction for vendor development doc. No. CLW/MLAS/EL/WI/Rev.1 dtd. 01.08.2015.

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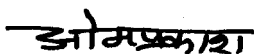
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## CHAPTER-5


### RECOMMENDATIONS

Based on the deliberation in previous chapters, committee recommends the following:

1. The present system of development of these five items through the process of ToT including ToT fees does not have relevance and may be dispense with.
2. The system as mentioned below should be adopted for development of these 5 items.
  - 2.1 Firms have to fulfill the requirement of STR which is available with CLW for each of the five items in ToT. These STRs may be reviewed and jointly issued by RDSO and CLW. STR may include the clause for new entrants for having MoU with national/international companies with expertise in the related field.
  - 2.2 Capacity assessment of the firm for compliance of STR shall be carried out jointly by officers not less than JAG/SG of RDSO and CLW. On successful capacity assessment duly approved by GM/CLW, a developmental order can be placed by CLW along with necessary documents for manufacturing.
  - 2.3 Prototype inspection of the equipment should be carried out jointly by CLW & RDSO.
3. On clearance of prototype, the equipment shall be subjected for extensive field trial for nine months or 1,00,000 km, whichever is earlier. On satisfactory field trial report of user Railways, the firms shall be given Part-II status for the equipment.
4. Quantity required for evaluation of performance before up-gradation of vendors from Part-II to Part-I will be 10 to 15% of the annual requirements of production of CLW for rolling stock. The period for monitoring the performance of these items will be two years as per Railway Board's letter No. 2010/Elect(Dev)/225/1 dtd. 07.06.2010 (Annexure-5).
5. Present ToT partners who have already successfully supplied & commissioned 10 to 15% of the annual requirements of production of current year for rolling stock of CLW for these five items (presently under ToT) shall be treated as Part-I.

  
(O.P. Kesari) 03.8.16  
EDSE/Co-Ord.

  
(B.B. Singh) 03.8.16  
CEE/CLW

  
(A.K. Chattopadhyay)  
CELE/ER

## Annexure-1/1

वी. शंकर  
प्रबंधक  
V. SHANKER  
GENERAL MANAGER



चिट्ठागंजन लोकोमोटिव कारखाना  
चिट्ठागंजन - 713 221 (पश्चिम बंगाल)  
CHITTAAGANJAN LOCOMOTIVE WORKS  
CHITTAAGANJAN - 713 221 (West Bengal)  
फोन Phone : (91 341) 242466  
फैक्स Fax : (91 341) 242464  
ईमेल E-mail : gmw@clw.railnet.gov.in

D.O.No. C-D&D/1/14  
Dated: January 29, 2009

Dear Shri Singh

Sub: Dispensation of ToT fees for 3-phase locomotive items.  
Ref: Board's letter No. 93/Elect (Dev)/440/18 (Vol.II) TOT dtd.  
14.07.2008.

Indian Railways received propulsion technology from M/s. ABB/Switzerland. Some equipments were decided to be out sourced since there were no facilities for manufacture of those equipments at CLW. It was thus necessary to involve the industry at that stage so that the complete transfer of technology is ensured. For this, capable vendors were selected through tendering process and assessment. The technology was passed on to the selected industries, who were called as ToT partners. This was not only to bring down the cost of the equipment compared to the imported cost but also to ensure easy availability of material to match with pace of 3-phase locomotives production at CLW. Accordingly, in case of those equipments like transformer, power converter, auxiliary converter, control electronics and traction motor, CLW charged ToT fees. This was basically to ensure commitment of the firm to develop the item after acquiring the technology from CLW.

As per practice, the decision to give ToT to a firm was being taken by Board on the basis of assessment report of high level committee of CLW officers.

Since all major equipments are procured through open tender there is no restriction or bar on any new prospective firm to quote. The tender conditions only stipulate that CLW reserves the right to procure the full requirements from approved sources but does not say that the procurement will be only restricted to approved sources. With the same provision number of new firms like M/s. ABB, M/s. Stesalit, M/s. Areva etc have participated in the open tenders and their cases were processed for Board's approval for inclusion as ToT partner and Board have communicated their approval already in case of M/s. ABB for IGBT based Auxiliary Converters. (the case of M/s. Areva T&D and M/s. Stesalit is awaiting a policy decision in this regard).

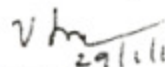
## Page-2

Development of additional sources will be in the interest of CLW, by increasing the competition and widening the supplier base. The ToT fee is a hindrance in this direction. Initial purpose of ToT fee (of ensuring seriousness and commitment on the part of vendors) having been served, there is no justification for continuing the same at present after a lapse of more than 10 years. Moreover, whatever charges are paid by the firm to CLW in the form of ToT fee is subsequently recovered by them through material supply to CLW.

Calling for separate EOI for inclusion as ToT partners and processing the proposals for Board's approval is a time consuming process which is not practicable as it has to be done for each product separately. The same purpose is served by placing development orders on new sources who participate against open tenders, subject to their fulfilling capacity/capability requirements; over a period of time, they get upgraded as Part-II/Part-I suppliers.

I would, therefore, recommend that we dispense with the practice of ToT fees for development of 3-phase locomotive items / equipments and permit CLW to develop new sources by undertaking capacity/capability assessment. This will help in speeding up the process and help us to develop additional sources, wherever needed, in the shortest possible time. As on date requests received from M/s. Areva T& D and M/s. Stesalit for inclusion as new suppliers for 3 phase transformers, is held up on this account. I would request you to look into the matter personally and communicate suitable instructions.

Yours sincerely

  
29/11/04  
(V.Shanker)

Shri Sukhbir Singh,  
Member Electrical,  
Railway Board,  
New Delhi.

**Annexure-1/2**

INDIAN RAILWAYS  
CENTRE FOR DESIGN & DEVELOPMENT  
CHATTARANJAN LOCOMOTIVE WORKS  
At Chattaranjan, West Bengal, PIN-713401  
Tel: 033-2452451, 2452452, 2452453, 2452454, 2452455

Dated: March 8, 2013

No: C-D&amp;D/1/24

Sr. EDSE  
RDSO, P.O. Manaknagar  
Lucknow – 226 011,  
(Fax- 0522-2452581)

Indian Railways has signed transfer of technology agreement in 1997 with ABB Switzerland for the production of 3-phase locomotives with GTO based propulsion system.

2. Due to the obsolescence of GTO Indian Railways has decided to progressively adopt IGBT based traction converter and auxiliary converter. Board has set a target of 70% of 3-phase locomotives to be turned out with IGBT based converters for year 2013-14.
3. Vide record notes dated 26.08.2005 enclosed as Annexure, Board has observed that it is desirable and adequate pursue adoption IGBT based technology by development of IGBT based traction converters and IGBT based Auxiliary Converters with the help of resources and capabilities developed by IR and its ToT partners.

Subsequently, the development and procurement of IGBT based traction and auxiliary converters are being done through ToT partners.

4. MICAS software is the property of IR and the procurement of MICAS based converter had to be restricted to ToT partners which had been shared MICAS technology. In case of IGBT converter with TCN compatibility, IR shall not be possessing the ToT. Therefore ToT agreement shall not be of much relevance.
5. As of now the scenario has changed as elucidated below:
  - a) IR has undertaken migration to IGBT based technology at fast rate as given below:



Year		Production of 3-phase locos
2010-11	-	03 locos with IGBT based Converters
2011-12	-	Nil locos with IGBT based Converters
2012-13	-	40 locos with IGBT based Converters (anticipated)
2013-14	-	130 locos with IGBT based Converters (Target)

- b) Procurement of complete propulsion system in which TCN compliant software has been left to the firm.
- c) Development of open control VCU in which TCN compliant software shall be compatible to GTO and IGBT based converters.

Therefore, it is now time to relax the condition of procurement of IGBT based converters through ToT partners and open it to non-ToT suppliers also. This would result in –

- i) Leading players in the field like TOSHIBA, SIEMENS, ALSTOM, etc can also develop and supply the IGBT based converters.
- ii) Faster delivery to meet the increasing requirement.
- iii) Faster adoption of ever-changing technology in the field of power electronics.
- iv) Because of the open competition, IR shall get a benefit of better technology from leading players at a reasonable price.

RDSO is requested to consider above and advise further after obtaining the sanction of competent authority.

(Shailendra Tripathi)  
Chief Electrical Engineer

Copy to:

EDEE/RS, Railway Board, Rail Bhawan, New Delhi- 110 001.

- For kind information.

(Shailendra Tripathi)  
Chief Electrical Engineer

Annexure-1/3

भारत सरकार GOVERNMENT OF INDIA  
रेल मंत्रालय MINISTRY OF RAILWAYS  
(रेलवे बोर्ड RAILWAY BOARD)

No. 2006/Elect.(TRS)/441/8 Pt.

New Delhi, Dated : 10.06.2013

Director General (Elect.)  
RDSO  
Manak Nagar  
LUCKNOW

**Sub: IGBT Based Traction and Auxiliary converters.**

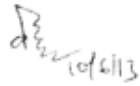
**Ref : CLW letter No. C-D&D/T/24 dated 06.03.13**

CLW vide its letter referred above has proposed procurement of IGBT based converters through Non-TOT partners also.

RDSO should examine the matter duly taking in to account progress in development of open control TCN compliant VCU which if fully adopted, can be integrated with the IGBT converters of different makes from TOT/Non-TOT partners.

It is therefore advised that clear recommendations on the CLW's proposal be submitted by RDSO by 20.06.13.

b. 2006.

  
(Ved Pal)  
Exe. Director Elect. Engg. (RS)  
Railway Board



Annexure-1/4

Reminder

भारत सरकार GOVERNMENT OF INDIA  
रेल मंत्रालय MINISTRY OF RAILWAY  
(रेलवे बोर्ड RAILWAY BOARD)

RDSO/IR/PL

No. 2006/Elect.(TRS)/441/8 Pt.

New Delhi, Dated : 10.06.2014


Director General (Elect.)  
RDSO  
Manak Nagar  
LUCKNOW

**Sub: IGBT Based Traction and Auxiliary converters.**

**Ref :** (i) Board letter of even no dated 10.06.2013  
(ii) CLW letter No. C-D&D/T/24 dated 06.03.13

Board vide letter under ref(i) advised RDSO to examine the proposal of CLW for procurement of IGBT based converters through TOT/Non-TOT partners duly taking in to account progress in development of open control TCN compliant VCU which if fully adopted, can be integrated with the IGBT converters of different makes. The reply is still awaited.

It is therefore advised to submit the reply at the earliest.

  
(Sumit Bhatnagar)  
Dir. Elect. Engg. (RS)  
Railway Board

e-mail: dir.rsrb@gmail.com

## Annexure-1/5

Fax : (0522)- 2465715  
 Telephone: (0522)-2450374  
 Email : sredse@gmail.com



भारत सरकार – रेल मंत्रालय  
 अनुसंधान अभिकल्प और मानक संगठन  
 लखनऊ & 226011  
 Government of India - Ministry of Rlys.  
 Research, Designs & Standards  
 Organization, LUCKNOW - 226011

No. EL/11.5.5/1/IGBT

Dt.09.07.2014

✓ Secretary (Electrical),  
 Railway Board,  
 Rail Bhawan,  
 New Delhi-110 001

**Sub:** Opening of development of 3 phase loco equipment through Non TOT suppliers.

**Ref.:** i) CLW's letter No.C-D&D/T/24 dtd. 06.03.2013.  
 ii) Rly. Bd.'s letter No.2006/Elec(TRS)/441/8Pt. dtd. 10.06.2013.  
 iii) Rly. Bd.'s letter No.2006/Elec(TRS)/441/8Pt. dtd. 10.06.2014

Vide reference above, CLW has sought RDSO's point of view to relax the conditions of procurement of IGBT traction converters only through TOT partners and open it to non-TOT suppliers also. In this regard, it is appropriate and necessary to look into the matter in the perspective of transfer of technology for all the similar items i.e. Traction Converter, Auxiliary Converter, VCU, Transformer and Traction Motor, as a whole.

IR received Technology for Three Phase Drive Locomotive from M/s. ABB, Switzerland, and for the above mentioned five technically complex equipment it was decided by CLW to outsource manufacture of these items, as there were no facilities available for manufacturing these equipment at CLW/Railways, except for traction motor, which was to be manufactured at CLW as well.

In this situation it was necessary for CLW to ensure complete transfer of technology directly to the selected industry at that stage itself. To ensure this, it was necessary that the selected supplier's personnel get the required training and understanding at OEM i.e. M/s ABB, Switzerland works through direct interaction, which was necessary for complete technology transfer and to develop full capability of the vendor to establish manufacturing at their works in India.

For indigenous manufacturing of these items, capable vendors were selected by CLW through a selection process. Manufacturing of these equipment indigenously was a step taken by CLW to bring down the cost of the equipment as compared to the imported and also to ensure easy availability to match with the pace of production of 3-phase locomotives' at CLW.

contd....

After transferring the technology to Indian manufacturers through the above process, it was also necessary to have full commitment of these vendors that they manufacture and support these equipment after acquiring the TOT, the TOT fee was akin to commitment fee. Except for these five items no TOT fee has ever been charged for any other equipment/part when outsourced by CLW.

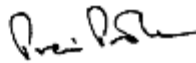
Complete technology for the 3-phase drive locomotives WAG9 and WAP5 was fully bought by IR (CLW) and only for these five equipment technology was given to these selected industries at the initial stage itself by CLW, to manufacture these equipment in India, who were being later referred to as "TOT Partners".

The purpose of taking TOT fee which was to ensure seriousness and commitment of the vendors, has been well served, this had relevance only at the initial stage and has no relevance now after more than 14 years. Besides, the fact is that whatever TOT fee is paid by the firm is subsequently recovered by them from Railways.

Development of additional sources is in the interest of Railways, to have better competition and widening the supplier base. The process of giving TOT has been a serious deterrent in the development of vendors for these five items. Since all the major equipment of the 3-phase locomotives are being procured through open sources based on RDSO/CLW specifications and there is no restriction or bar on new prospective firms to quote, the same needs to be followed for these five items also.

Hence, it is recommended and proposed that the practice of charging TOT fee for the development of above mentioned 3-phase Locomotive items/equipment be dispensed with and the new sources are allowed to be developed as per the procedures followed for any other item. This will enable speeding up the process of development of additional sources by RDSO/CLW as needed in the shortest possible time.

Railway Board is requested to approve the recommendation/proposal as indicated in the preceding paragraph.



(Pravin Pradhan)  
for Director General (Elect.)

Encl: Nil.

**Copy to:-**

- Chief Electrical Engineer, Chittaranjan Locomotive Works, Chittaranjan-713 331, West Bengal: For kind information.



(Pravin Pradhan)

for Director General (Elect.)

Encl: Nil.

## Annexure-1/6

Recd. In R & D DE. 07/08  
 2016  
 2016  
 2016  
 Sent to Cea. Officer Dt. 04/08

भारत सरकार GOVERNMENT OF INDIA  
 रेल मंत्रालय MINISTRY OF RAILWAY  
 (रेलवे बोर्ड RAILWAY BOARD)

DG	
ADGI	
SE. EDIED	6/8/16
DATE	

No.2006/Elect(TRS)/441/8 Pt.

New Delhi, Dated :25.07.2014

Director General (Electrical)

RDSO  
 Manak Nagar  
LUCKNOW

Sub:- Opening of development of 3 phase loco equipment through Non TOT suppliers.

Ref:- RDSO letter No.EL/5.5/1/IGBT dated 09.07.2014

RDSO vide letter under reference has proposed to dispense with the practice of charging TOT fee for the development of Traction Converter, Auxiliary Converter, VCU, Transformer and Traction Motor, The proposal has been examined in the Board however following clarifications may be submitted for better appreciation

- (i) Confirmation be submitted that, as per TOT contracts, there is no restriction on IR to dispense with the TOT contracts for further procurements, and
- (ii) Effect of proposed dispensation on present status of ongoing TOT contracts for these equipments.

RDSO is advised to clarify above queries in consultation with CLW at the earliest for further disposal of the proposal.

(Sumit Bhatnagar)

Dir. Elect. Engg. (RS)

Railway Board

e-mail: dir.rsr@gmail.com

Copy to:

CEE/CLW: for information and necessary action.

## Annexure-1/7

INDIAN RAILWAYS  
CENTRE FOR DESIGN & DEVELOPMENT  
CHITTARANJAN LOCOMOTIVE WORKS  
PO: Chittaranjan, West Bengal. PIN: 713331  
Fax: (+91) 341- 2526133, Ph: (+91) 341-2525550



No: C-D&amp;D/T/24

Date: October 1, 2014

Sr. EDSE  
RDSO, P.O. Manaknagar,  
Lucknow – 226 011,  
(Fax- 0522-2452581)

**Sub:** Clarification to queries regarding dispensation of ToT fee for the development of 3-phase electric locomotive items.

**Ref:** (i) Rly. Brd's letter No. 2006/Elect (TRS)/441/8 Pt. Dated: 25.7.2014.

(ii) DG (Elect.)/RDSO's letter No. EL/11.5.5/1/IGBT dated: 04.09.2014.

Vide reference above, Railway Board has sought some clarifications regarding dispensation of ToT fee for development of 3-phase electric locomotive items through Non-ToT suppliers. The point wise clarification is as follows:

**Para (i)**

The ToT agreement signed in 1993 by Indian Railways with ABB, Switzerland (now Bombardier Transportation) restricted IR to transfer the technology to any private Indian company which is a competitor of ABB or having an association with competitors of ABB during the agreement period of 10 years. But after completion of the currency/validity of the Contract in 2003, IR acquired full freedom to use Technical information supplied by the Contractor to the manufacturer, use and sell IR products without any let or hindrance.

Therefore, as regard to ToT agreement signed in 1993, there is no restriction on IR, after 10 years i.e. 2003 onwards, to dispense with the ToT contracts for further procurement.

**Para (ii)**

At present, CLW's ongoing contracts of ToT are free from any kind of restriction on IR. Although, it has restricted ToT partners from disclosing information or selling product without prior approval of IR, no restriction, of any sort, has been imposed on IR.



As of now the scenario of technology has changed worldwide during the long span of 18 years since CLW had taken up the technology. The main factors are –

- (a) The existing GTO technology with MICAS based communication protocol have become obsolete and replaced by IGBT (IGCT in near future) and TCN based communication protocol which is internationally known and easily available.
- (b) There is need to develop and increase indigenous sources to cater the need of customised technology for IR applications.
- (c) Indian industries have become well conversant and prepared for rolling stock technology with the start of Metro Railways in India.
- (d) Dispensation of ToT will help to widen indigenous vendor base and will ensure competitive price and better availability of equipments.
- (e) It is right time to waive off or to dispense with the procedure for completing ToT formalities and it is anticipated that there shall not be any adverse effect of proposed dispensation of ToT on present status of ongoing ToT contracts.

This is for your kind information and necessary action further.



Chief Electrical Engineer/L&S

Copy for kind information to:

Director Elect. Engg. (RS), Railway Board, Rail Bhawan, New Delhi- 110 001.



Chief Electrical Engineer/L&S

## Annexure-1/8

Fax : (0522)-2452581  
 Telephone: (0522)-2465715  
 Telegram : 'RAILMANAK', LKO  
 Email: dsetplgroup@gamil.com



भारत सरकार - रेल मंत्रालय  
 अनुसंधान अभिकल्प और मानक संगठन  
 लखनऊ - 226011  
 Govt. of India - Ministry of Railways  
 Research, Designs & Standards Organization,  
 LUCKNOW - 226011

No. EL/11.5.5/1/IGBT  
 Director (Elect. Engg),  
 Railway Board, Rail Bhavan,  
 New Delhi-110 001

Dt. 21.10.2014

(Kind attn: Sumit Bhatnagar, DEE/RS/RB)

**Sub:** Opening of development of 3 phase loco equipment through Non TOT suppliers.

**Ref:** i) Rly.Bd.'s letter No.2006/Elec (TRS)/441/8Pt. dtd.10.06.2013 & 10.06.2014.  
 ii) This office letter even no. dated 09.07.2014  
 iii) Rly. Bd.'s letter No.2006/Elec (TRS)/441/8Pt. dtd.25.07.14  
 iv) CLW's letter No.C-D&D/T/24 dtd. 01.10.2014.

In continuation to this office letter under reference (ii), clarification has been sought from CLW for dispensation of TOT contract as advised vide Railway Board's letter under reference (iii). CLW vide letter under reference (iv) furnished clarification as summarized below:

- i. CLW stated that as per the TOT agreement signed in 1993, there is no restriction on IR after a lapse of 10 years i.e. 2003 onwards to dispense with TOT contracts for further procurement.
- ii. In connection with proposed dispensation on present status of ongoing TOT contract, CLW has clarified that at present ongoing contracts of TOT are free from any kind of restrictions on IR. Although it has restricted TOT partners from disclosing the information or selling the products without prior approval of IR, no restriction of any sort has been imposed on IR. CLW has further stated that there is a need to develop and increase indigenous sources to cater the need of customized technology for IR applications and it is right time to waive off or to dispense with the procedure for completing TOT formalities.

Railway Board is again requested to approve the recommendation/proposal as submitted vide RDSO's letter under reference (ii).

(A.K. Goswami)  
 for Director General (Elect.)

Encl: Nil  
 Copy to:-

Chief Electrical Engineer, Chittaranjan Locomotive Works, | For information please  
 Chittaranjan-713 331, West Bengal.

(A. K. Goswami)  
 for Director General (Elect.)

Encl: Nil

## Annexure-1/9

Fax : (0522)-2465715  
 Telephone: (0522)-2450374  
 Email : sredse@gmail.com



भारत सरकार — रेल मंत्रालय  
 अनुसंधान अगिकल्प और मानक संगठन  
 लखनऊ — 226011  
 Government of India - Ministry of Rlys.  
 Research, Designs & Standards Organization,  
 LUCKNOW - 226011

No. EL/11.5.5/1/IGBT

Date: 03-06-2016

Secretary (Electrical),  
 Railway Board, Rail Bhavan,  
 New Delhi-110 001

[Kind Attn: Shri A. K. Goswami Director/RS/RB]

**Sub:** Opening of development of 3 phase loco equipment without  
 Transfer of Technology (TOT) process.

**Ref.:** i) CLW's letter No.C-D&D/T/24 dtd. 06.03.2013.  
 ii) Rly. Bd.'s letter No.2006/Elec(TRS)/441/8Pt. dtd. 10.06.2013.  
 iii) Rly. Bd.'s letter No.2006/Elec(TRS)/441/8Pt. dtd. 10.06.2014  
 iv) This office letter even no. dated 09.07.2014  
 v) Rly. Bd.'s letter No.2006/Elec (TRS)/441/8Pt. dtd.25.07.14  
 vi) CLW's letter No.C-D&D/T/24 dtd. 01.10.2014.


1. CLW sought RDSO's point of view to relax the conditions of procurement of IGBT traction converters only through TOT partners and open it to non- TOT suppliers also. In this regard, it is appropriate and necessary to look into the matter in the perspective of transfer of technology for all the similar items i.e. Traction Converter, Auxiliary Converter, VCU, Transformer and Traction Motor, as a whole.
2. In this regard RDSO had given the comments to Railway Board, vide this office letter no. EL/11.5.5/1/IGBT dated 09.07.2014.
  - 2.1 For indigenous manufacturing of these items, capable vendors were selected by CLW through a selection process. Manufacturing of these equipments indigenously was a step taken by CLW to bring down the cost of the equipment as compared to the imported and also to ensure easy availability to match with the pace of production of 3-phase locomotives' at CLW.
  - 2.2 After transferring the technology to Indian manufacturers through the above process, it was also necessary to have full commitment of these vendors that they manufacture and support these equipment after acquiring the TOT, the TOT



fee was akin to commitment fee. Except for these five items no TOT fee has ever been charged for any other equipment/part when outsourced by CLW.

- 2.3 Complete technology for the 3-phase drive locomotives WAG9 and WAP5 was fully bought by IR (CLW) and only for these five equipments technology was given to these selected industries at the initial stage itself by CLW, to manufacture these equipments in India, who were being later referred to as "TOT Partners".
- 2.4 The purpose of taking TOT fee which was to ensure seriousness and commitment of the vendors, has been well served, this had relevance only at the initial stage and has no relevance now after more than 20 years.
- 2.5 Railway Board constituted a committee; vide letter no. 2006/Elect (TRS)/441/8 PT.3 dated 27-01-2016 for proliferation of IGBT Technology in 3-phase loco. Based on the recommendation of the committee, Railway Board vide letter no.2006/Elect(TRS)441/8 Pt.3 dated 19-04-16 has advised that IR should expeditiously move towards procurement of IGBT propulsion system in sets only . Moreover, IR has already switched over to IGBT technology 100% and procurement of GTO based converters has been stopped by CLW. The existing TOT was applicable to GTO converters only. Since IR has switched over to different technology (i.e. IGBT) coupled with TCN compliant VCU to be procured as propulsion set, the norms for TOT do not apply for development/proliferation of IGBT technology as propulsion set.
- 2.6 Similarly in traction transformer, (the originally procured with TOT) has been upgraded with following major modifications:
- (i) Twin winding of 622.5 KVA for each Hotel Load converter to feed train power supply
  - (ii) Consequent upon modification in Hotel Load winding, Transformer capacity has also been upgraded to 7775 KVA as the earlier capacity of 7500 KVA was inadequate.
- And therefore, the earlier transformer has undergone major upgradation to meet the new requirement and therefore TOT is not applicable.

- 2.7 Rotors of traction motors type 6FRA6068 used for WAG9 locos have also been modified by having scheme-I/scheme-II (RDSO specification no. RDSO/2007/EL/SPEC/0060, Rev-0 and specification no. RDSO/2007/EL/SPEC/0061, Rev-0). Stators of traction motors type 6FRA6068 have been modified as per modification sheet no. RDSO/2007/MS/0355 rev-02. These are major design modifications. Therefore presently traction motors of three phase locomotives have also undergone major changes and therefore TOT does not apply to traction motors of three phase locomotives.
- 2.8 Considering the above facts, it is noted that five items which were under the cover of TOT (Traction converter, Auxiliary converter, VCU, Transformer and traction motor) have undergone major modifications/changes/up-gradations as explained above. Therefore, TOT has no relevance in the present scenario for any of these five equipments earlier covered under TOT.
3. At present all the major equipment of the 3-phase locomotives are being procured through open source based on RDSO/CLW specifications and there is no restriction or bar on prospective firms to quote. In view of CLW letter no. C-D&D/T/24 dated 06-3-2013 & 01-10-2014, the development of items like IGBT based traction converter, IGBT based auxiliary converter, transformer and traction motors of 3-phase locomotives need to be opened for development without TOT. This will help in development of additional sources which will be in the interest of IR to have better competition and widening of vendor base.

  
(O.P. Kesari) 03.6.16

For Director General (Electrical)

Copy to:-

Chief Electrical Engineer, Chittaranjan Locomotive Works, Chittaranjan-713 331,  
West Bengal: For kind information. This connects your letter referred above.

## Annexure-2

File EL/3.1.35/17

SN 40

GOVERNMENT OF INDIA (BHARAT SARKAR)  
MINISTRY OF RAILWAYS (RAIL MANTRALAYA)  
(RAILWAY BOARD)

2003/Elect(Dev)/440/18/17

New Delhi - 110 001  
Dated : 05.09.2004

General Manager,  
Varanasi Locomotive Works,  
Varanasi.

Director General Standards (Elect)  
RDSO,  
Manak Nagar  
Lucknow.

Sub: Adoption of IGBT technology for 3-phase electric locos  
being manufactured indigenously by CLW -  
implementation of items featuring in the budget speech  
of Hon'ble MR.

Enclosed please find the record notes of discussion held in Railway  
Board on the above mentioned subject. Board(ML) has approved the  
action plan in para 3.1 of the said record notes for expediting the  
development of IGBT technology for locos in pursuant budget  
announcement of Hon'ble MR.

As above.

(A.K.Dutta)  
Exec. Dir. Elect. Engg. (Dev)  
Railway Board.

Very imp. + urgent  
Please study and discuss.  
Copies in relevant files.  
Copy to DSE - 2  
Sd/- S K Sahas  
Copy given to DSE-2  
27.9

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**Record notes of discussion held in Railway Board on 26.8.05 in connection with adoption of modern IGBT technology for 3-phase electric locos being manufactured by CLW.**

**PRESENT**

<u>CLW</u> S/Shri	<u>RDSO</u> S/Shri	<u>Railway Board</u> S/Shri
A.K. Vohra, CEE	I.C. Sharma, Sr.EDSE	Kulbhushan, Adv.EE/RS
Sujeet Mishra, Dy.CEE/D&D	N.K. Sinha, DSE	A.K. Dutta, EDEE/Dev

- 1.1 Development of IGBT based propulsion system consisting of traction converter, aux converter & vehicle control unit with open control system was taken up in March, 2002 by issuing necessary guidelines from Railway Board. Adoption of IGBT technology for electric locomotives is one of the important items of Hon'ble MR's Budget Speech and its implementation is being closely monitored by Board. The adoption of IGBT technology for 3-phase locos mainly consists of development of traction converter with IGBT devices and development of aux converter with IGBT devices. CLW is the identified agency for implementation of these items in association with RDSO for drawal of specification and other associated activities of development.
- 1.2 Accordingly, tenders were invited and pre-bid conference held by CLW based on approved specification for development of traction propulsion system with IGBT technology.
- 1.3 The progress of implementation was reviewed with CLW & RDSO based on inputs obtained from various bidders in the global tender for development. The scope of development as per the developmental tender covers the following :
  - i. Development of entire propulsion system while retaining the transformer consisting of traction converter, aux converter, traction motor & VCU.
  - ii. The scope also covers improvement in haulage performance and increases in starting tractive effort based on operational experience of 3-phase locos.
  - iii. Addressing the issues of obsolescence and propriety at the equipment/card/ component level and software.

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- iv. Developing in house capability at CLW in vehicle level integration with open vehicle software platform to meet the changing haulage requirements by the operator.

1.4 After detailed discussion with CLW & RDSO, it was concluded that the present scope of development encompasses and addresses a number of issues and its inter-relations being very complex the development process would take considerable time (8-10 years) and therefore should be pursued as a long term development project taking into account changes in requirement of motive power scenario on IR as a result of a number of new developments like dedicated freight corridor, axle load increase in carrying capacity.

1.5 Increase in horse-power is also an issue to be incorporated, if decided.

2.1 In order to address only the issue of obsolescence of GTO and inherent technological benefits of IGBT, it was therefore concluded that it would be desirable and adequate to pursue adoption of IGBT technology, development of the following with the help of resources and capabilities developed by IR and its TOT partners :

- i. IGBT based traction converter as functional replacement with existing GTO converter and its integration with existing VCU done in case of GM Locos.
- ii. Development of IGBT based aux converter for functional replacement of existing GTO. aux converter with possible increase in capacity.

2.2 In pursuance of implementation of Hon'ble MR's budget speech, the two developments could be implemented faster within a timeframe of 2-3 years.

3.1 Following action plan was therefore formulated for further action :

**A. TRACTION CONVERTER -**

- i. The necessary revision to the existing traction converter specification could be finalized by CLW in consultation with RDSO within a month's time and submitted to Board approval.
- ii. Suitable advice would be issued to CLW for procurement of loco sets of traction converters as per the revised specification with IGBT technology and compatibility with existing vehicle control system. This would be tried out on locos in production with one prototype initially, followed by further refinement and proving.



- iii. The responsibility of integration of the traction converter with IGBT devices with the locomotive would be that of TOT partners. Support and assistance available with CLW & RDSO would be provided.

#### B. AUXILIARY CONVERTER FOR 3-PHASE LOCOS -

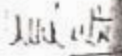
- i. Specification for aux converter with IGBT technology would be developed by CLW in consultation with RDSO and submitted to Board for approval. While finalizing the specification the capacity upgradation in view of rating limitations of the present aux converter would be kept in view. As per preliminary assessment by RDSO enhanced rating in the range of 120-130 KVA would be adequate. The existing configuration of three independent modules, its load sharing and switching over of aux loads in the event of failure of one aux converter without reduction in operational performance of loco should be retained as available with the existing aux converters. RDSO may take a view regarding the energy conservation feature available with existing aux converter which is already limited due to revised distribution of auxiliary loads in vague.
- ii. Board would issue necessary advice to CLW for procurement of 10 loco sets of aux converter with the specification drawn. This would be tried out on locos in production with one prototype initially, followed by further fitment after proving.
- iii. The responsibility of integration of these aux converters with the locomotive would be that of TOT partners. Support and assistance available with CLW & RDSO in this respect would be provided.

#### C. VEHICLE CONTROL SYSTEM -

- i. Present developments of Vehicle Control System in progress to build up in-house capability of vehicle integration by developing TCN compatibility with open platform software should also be expedited.
- ii. Long term development of VCU with indigenous hardware, software with partial assistance of Deptt of IT through C-DAC may continue to address component obsolescence, software propriety and possible cost reduction.

4.0 CLW would continue to pursue the present development in progress for TCN compatible open platform vehicle control system as indicated above so as to acquire in house further expertise in integration of various equipments/ sub-systems in the traction propulsion system.

- 5.0 The development of IGBT traction converter and aux converter should be pursued with top most priority as items of MR's budget speech and should be regularly monitored and feedback sent in the prescribed format already advised from Board.

  
(A.K. Dutta  
EDEE/De

No.2003/Elect/Dev/440/18/17, dated 29.8.2005

CC :

Adv.EE/RS for information and records.

Sr.EDSE/RDSO/ LKO for information & n.a.

GM/CLW for information & n.a.

CEE/CLW for information & n.a.

File No.2003/Elect/Dev/440/18/17.

By Fax  
L. Paine  
2/2/2005  
Dre (G)

COMPARISON  
OF THE TWO

26-8- 95

CONFIDENTIAL

Ref : CLW letter No.D&D/TOT/101 dt.24-3-95.

Annexure.

Kindly send a draft agreement form to be executed between GM/CLN and partners selected for examination in Board's office and approval for the documents.

1.	Transformer	50,00,000
2.	Traction Motor	35,00,000
3.	Power Converter	100,00,000
4.	Auxiliary converter	15,00,000
5.	Control electronics	32,00,000

- (i) 50% within 30 days of signing the Contract.
- (ii) 30% within 30 days of the complete delivery of the document.
- (iii) 20% of the total charge at the time of placement of first order.

Please treat it as most urgent.

(M. RANGACHARI)  
Executive Director, Elec. Engrg. (RS),  
Railway Board.

DA 1 As above. Railway Board.  
Hatched area to the S.D. Plan. Not given in the  
plan. S.D. Plan.

Abel



**Annexure-4****Number of equipment supplied as on 25.07.2016**

Description	AAL	ABB	AREVA	BHEL	BTIL	CGL	EMCO	Hirect	Hi Volt	Stesalit	Saini
SR (IGBT)	-	139	-	162	127	14	-	-	-	-	-
SR (GTO)	-	-	-	258	218	119	-	-	-	-	-
BUR (IGBT)	17	-	-	151	-	239	-	-	-	-	-
BUR (GTO)	9	-	-	208	243	126	-	-	-	-	-
TM (G-9 & P-7)	-	-	-	227	-	98	-	-	-	-	32
TM (WAP-5)	-	-	-	52	-	38	-	-	-	-	-
TFP 6531	-	10+95	-	274	105	173	60	16	46	1	-
TFP 7475		40	01	109	70	97	1	1	20	2	-
TFP 7775		12	-	37	-	14	1	1	16	-	-
Central Electronics	-	-	-	421	471	239	-	-	-	-	-

## Annexure-5

**GOVERNMENT OF INDIA (BHARAT SARKAR)  
MINISTRY OF RAILWAYS (RAIL MANTRALAYA)  
(RAILWAY BOARD)**

No.2010/Elect(Dev)/225/1

New Delhi - 110001  
Dated 07.06.2010

**Director General,  
RDSO, Manak Nagar,  
Lucknow.**

**Sub: - Review of working of RDSO- Streamlining the policy of up gradation of vendors & agencies for vendor development.**

**Ref: -** (i) ED/E&R's note no. 2009/E&R/3400/9 dt 29.12.09.  
(ii) CRB'S DO no. 2009/E&R/RDSO/O/1 dt 18.12.09.  
(iii) Sr EDSE/RDSO letter no. EL/Sr. EDSE/Misc dt 15.01.10  
(iv) DG/RDSO, DO no. DG/CRP-9/AO/Mech dt. 27.01.10  
(v) DG/RDSO, DO no. EL/8.1.10/EM dt. 25.01.10

Pursuant to Hon'ble MR's directives, ED's committee of Railway Board reviewed the vendor approval work and the organizational structure of RDSO.

2.0 Sr EDSE/RDSO (member of ED's Committee) constituted an internal committee of Directors of RDSO (Loco, TI, EMU TL/AC and PS) to review it's list of vendors (Pt-I & Pt-II) and furnished RDSO's recommendation vide ref (iii) which have been examined in Railway Board and a considered view taken.

3.0 Board (ML) have approved the following.

3.1 Items critical to the performance for Rolling Stock (Loco, EMU, TL/AC) and TI have been retained at RDSO.

3.2 Revision is indicated in enclosed lists. Agencies responsible for vendor approval/development, item wise are also indicated.

For such items which have now been transferred to Production Unit & Zonal Railways, the Specifications will continue to be controlled by RDSO

3.3 Quantities required for evaluation of performance before up gradation of vendors from Pt-II to Pt-I will be 10 to 15% of the annual requirements of production for rolling stock and for Railway Electrification

3.4 The period for monitoring the performance of different items will be one year except for the following items for which it would be 2 years.

S.N	Item Description
1	All types of bearings
2	Main Transformer for Locomotives/EMUs
3	All types of cables
4	Computer Controlled/Microprocessor based Brake system for Electric Locomotives/EMUs
5	Rubber components for transmission systems
6	IGBT/IGCT/GTO based traction converter, auxiliary converter for rolling stock
7	Asynchronous Traction Motors
8	Vehicle Electronics/Control Unit for electric rolling stock

3.5 RDSO's list of vendors (Pt-I & II) will be monitored by Railway Board on half yearly (April & October) basis. Feedback in proforma enclosed shall be given by respective EDs/Sr EDs of RDSO for these items.

Necessary action may be taken accordingly.

List of enclosure: 1 Feed back proforma (Annexure-I)  
2 Revision list, Electric Locomotive (Annexure-II)  
3 Revision list, Electric Multiple Units (Annexure-III)  
4 Revision list, Traction Installation (Annexure-IV)  
5 Revision list, TL&AC (Annexure-V)  
6 Revision list, Energy Management (Annexure-VI)  
Copy to: 1. GM/CLW, GM/CORE, GM/COF, GM/RCF, GM/WR, GM/CR.  
2. CEEs of all ZRs, PUs, CORE & Metro/Kolkata.  
3. Sr EDSE/RDSO w.r.t. letter dt 15.01.2010  
4. Adv L (RS), Adv L (G), Adv (RE), ED (EEM) Rly. Board.

(Sudheer Kumar)  
Executive Director,  
Electrical Engineering (Dev.),  
Railway Board

## Annexure-6

GOVERNMENT OF INDIA  
MINISTRY OF RAILWAYS  
(RAILWAY BOARD)

11/16/16  
Sd/- Secy to GM  
CEE

No. 97/Elect.(TRS)/113/4 Pt.

New Delhi, Dated : 02.08.08

General Manager (Elect),  
Chittaranjan Locomotive Works,  
CHITTARANJAN

Director General (Elect)  
R.D.S.O., Manak Nagar,  
LUCKNOW

Sub : Development of Three Phase Traction motors for WAGs/WAP7 locos

IR obtained technology from M/s Bombardier Transportation (earlier ABB), Switzerland in 1990s to manufacture three phase Traction Motors in CLW and also by selected Indian manufacturers i.e. M/s BHEL, CGL and REC. Since the original procurement, there have been changes in pattern of train operation requiring locos to haul higher loads on steeper gradients. The three phase traction motor, design & construction of which has undergone upgradation by RDSO in consultation with CLW and Industry through a number of modifications, is now required to be made to a new performance requirement. Also, high torque motors is a directive to be pursued.

As production of three phase locos is to increase, it has been considered to develop additional sources for traction motors to the upgraded performance. Board (ML) have directed that:

- (i) CLW should firm up specification for the upgraded traction motors incorporating requisite modifications, in association with RDSO and frame STR following all guidelines for vendor development and specification approvals issued by Board vide letter no. 97/Elect(TRS)/113/4 Pt II dated 11.10.06.
- (ii) CLW shall advertise a developmental tender to the approved specifications for procurement of 5 loco sets of traction motors type 8008 A, from sources who may be capable and interested in developing complete traction motor to the modified design.
- (iii) The assessment of the firms shall be done by CLW in accordance with extant policy and that:
  - ✓ Developmental orders are given after ensuring compliance with STR.
  - ✓ Proto type traction motor should be delivered within 6 months.
  - ✓ Proto type traction motor to be in satisfactory service on loco for at least six months after which joint clearance of RDSO & CLW shall be mandatory for supply of balance TMs.
  - ✓ Payment of proto type TM to be released only after above clearance.
  - ✓ In case of failure, even after improvements, order to be cancelled.

As the performance specification requirements, design & construction features are to undergo several changes, in accordance with developmental work already done by RDSO, there shall be no transfer of technology requirement.

CLW/RDSO are advised to proceed further so that additional source(s) are available.

(Mehar Chandra)  
Dir. Elect. Engg. (RS)  
Railway Board  
e-mail: deers@rb.railnet.gov.in

1/TMD  
n.a.pl.

Sd/- (M)