



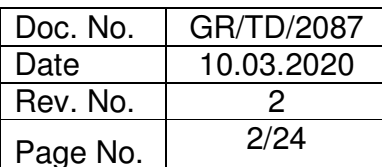
BEML LIMITED
BANGALORE
R & D CENTER

Doc. No.	GR/TD/2087
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Page No.	1/24

**Procurement Technical Specification
of Couplers and Draft Gear for
DMRC RS-15 Project**

(Supplies to be compatible and interchangeable with
existing DMRC RS-1,RS6 and RS13 Cars with
Improvements/Modifications)

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	Procurement Technical Specification of Couplers and Draft Gear for DMRC RS-15 Project	Doc. No.	GR/TD/2087
		Date	10.03.2020
		Rev. No.	2
		Page No.	3/24

Table of Contents

1. Introduction.....	5
1.1. General	5
1.2. General requirements	5
1.2.1. Train Configuration.....	5
1.2.2. Car Weights	6
1.2.3. Vehicle Performance Requirements	6
1.2.4. Track Parameter.....	7
1.2.5. Wheel diameter	7
1.2.6. Climatic & Environmental Conditions.....	7
2. Definitions and Abbreviations	8
2.1. Definitions.....	8
2.2. Abbreviations	8
3. Precedence of Documents	9
4. Scope of work.....	9
4.1. General	9
4.2. Design.....	9
4.3. Handing over of couplers	10
5. Scope of Supply	10
5.1. Hardware	11
5.2. Supply of Spares	12
5.2.1. Unit Exchange Spares.....	13
5.2.2. Consumable Spares.....	13
5.2.3. Mandatory Spares	13
5.2.4. Commissioning and DLP Spares.....	14
5.3. Interface Responsibilities	14
5.4. Weight.....	15
5.5. Quality Assurance Program	15
5.5.1. General	15
5.5.2. Quality assurance plan	15

	Procurement Technical Specification of Couplers and Draft Gear for DMRC RS-15 Project	Doc. No.	GR/TD/2087
		Date	10.03.2020
		Rev. No.	2
		Page No.	4/24

5.6. RAMS requirements.....	16
5.6.1. Reliability Analysis.....	16
5.6.2. Reliability Target.....	16
5.6.3. Maintainability Requirements.....	17
5.6.3.1. Design requirements	17
5.6.3.2. Maintainability Target	18
5.6.3.3. Master Maintenance schedule	18
5.6.4. Life Cycle Costs	18
5.6.5. Reliability and Maintainability Demonstrations	19
5.6.6. Safety Requirements	20
5.6.7. RAMS Deliverables	20
5.7. Fire Safety	21
5.7.1. General	21
5.7.2. Wire and cables.....	21
5.8. Interfaces with other systems	22
5.8.1. General	22
5.8.2. TIMS Interface.....	22
5.8.3. Control Interface.....	22
5.9. Design Submission	22
5.10. Operation & Maintenance Manual	23
5.10.1. Electronic manuals	23
6. Testing	23
6.1. General	23
6.2. Type Test & Routine Test, Coupler System	23
6.3. First Article Inspection (FAI).....	24
7. Appendices.....	24
8. Submittals with Technical Offer	24

	Procurement Technical Specification of Couplers and Draft Gear for DMRC RS-15 Project	Doc. No.	GR/TD/2087
		Date	10.03.2020
		Rev. No.	2
		Page No.	5/24

1. Introduction

1.1. General

This document specifies the requirements of Couplers and Draft Gear to be supplied for DMRC RS-15 project for Delhi Metro Rail Corporation Limited (hereafter DMRC). The Couplers and Draft Gear shall comply in all respects with DMRC Contract RS-15 Employer's Requirements General Specification (ERGS) and Employer's Requirements Technical Specification (ERTS). The Couplers and Draft Gear shall be compatible and interchangeable with the existing DMRC 'RS1, RS6 and RS13' type trains. The Couplers and Draft Gear supplies shall incorporate all approved/ would be approved variations, modifications and Hardware/ Software Engineering Change Proposals against the contracts RS1, RS6 and RS13 inline with ERTS. In case of any contraction between ERTS and approved/would be approved modifications (Hardware/Software Engineering Change Proposals) against the contract RS1, RS6 and RS13, the later will prevail.

BEML will carry out all required works and activities as Contractor for DMRC RS-15 project, while the supplier shall be responsible for all works required in this PTS with regard to Couplers and Draft Gear and shall be responsible for supporting the BEML activities as contractor for DMRC RS-15 Project.


1.2. General requirements

1.2.1. Train Configuration

M: Motor car,
DT: Driving Trailer car with pantograph
T : Non-driving Trailer car with pantograph.

Unit formation:
DT – M; M – DT; T – M;

The rake formation shall generally be as follows:
4 Car formation: DT – M – M – DT (Existing)

	Procurement Technical Specification of Couplers and Draft Gear for DMRC RS-15 Project	Doc. No.	GR/TD/2087
		Date	10.03.2020
		Rev. No.	2
		Page No.	6/24

6 Car formation: DT – M – T – M – M – DT (Existing)


8 Car formation: DT – M – T – M – T – M – M – DT (Proposed)

1.2.2. Car Weights

	DT-car	M-car	T-car
Tare weight	Less than 42,000 kg	Less than 42,000 kg	Less than 42,000 kg
Fully loaded	65,465 kg	67,480 kg	67,480 kg
Axle load	17,000 kg	17,000 kg	17,000 kg

1.2.3. Vehicle Performance Requirements

Item	All Corridors
Maximum design speed	90 kmph
Maximum operational speed	80 kmph
Round trip schedule speed with 30s station stops & 8% coasting (by time), excluding terminal station turn round time with fully loaded train.	34 kmph
Acceleration from 0 kmph to 30 kmph for fully loaded train on level tangent track (Notional)	$0.82 \text{ m/s}^2 \pm 5\%$
Service braking rate from 80 kmph to standstill up to fully loaded train on level tangent track.	$1.0 \text{ m/s}^2 \pm 5\%$
Emergency braking rate from 80 kmph to 0 kmph up to fully loaded train on level tangent track	1.3 m/s^2
Jerk rate	$0.75 \pm 0.05 \text{ m/s}^3$
Expected running adhesion but not limited to	18 %
Annual running distance of one train (for design purpose)	150,000 km

	Procurement Technical Specification of Couplers and Draft Gear for DMRC RS-15 Project	Doc. No.	GR/TD/2087
		Date	10.03.2020
		Rev. No.	2
		Page No.	7/24

1.2.4. Track Parameter


Description	Elevated and At-grade Corridor		Underground Corridor
	Ballasted	Ballast less (DFF)	Ballast less (DFF)
Track Laying Gauge	1676mm	1676mm	1676mm
Rail Type Main Line	UIC 860/0 60kg/m	UIC 860/0 60kg/m	UIC 860/0 60kg/m
Rail Profile	UIC 861-3	UIC 861-3	UIC 861-3
Rail Type Depot	IRS 52 kg/m	IRS 52 kg/m	IRS 52 kg/m
Inclination Of Rail (BG 1676 mm)	1 in 20	1 in 20	1 in 20
Minimum Radius of Curvature	300m-main line 200m-depot	300m-main line	300m -main line
Maximum Gradient Main Line	3%	3%	3%
Maximum Gradient Depot Connection	4%	4%	4%
Minimum vertical radius of Curvature	2500m	2500m	1500m

1.2.5. Wheel diameter

New:	860 mm
Half worn:	820 mm
Fully worn:	780 mm

1.2.6. Climatic & Environmental Conditions

Description	Limiting Values
Maximum ambient temperature (See note below)	47°C
Minimum temperature	3°C
Humidity	100% saturation during rainy season

	Procurement Technical Specification of Couplers and Draft Gear for DMRC RS-15 Project	Doc. No.	GR/TD/2087
		Date	10.03.2020
		Rev. No.	2
		Page No.	8/24

Rainfall	Rain occurs generally from June to September. Average annual rainfall is approximately 650 mm. Maximum rainfall in any 24h period is 50mm.
Atmosphere during hot season	Extremely dusty
Maximum wind load	150 kg/m ²
Vibration & Shocks	The equipment, sub-systems & their mounting arrangements shall be designed to withstand satisfactorily the vibration and shocks encountered in service as specified in IEC 61373
SO ₂ level in atmosphere	80 – 120 mg/m ³
Suspended particulate matter in atmosphere	360 – 540 mg/m ³

Note: The temperature of the metal surfaces of the vehicles when exposed directly to the sun, for long periods of time, may be assumed to rise to 70°C.

2. Definitions and Abbreviations

2.1. Definitions

The following definitions and abbreviations are applicable to the PTS.


- “DMRC” means the Employer for the Mass Rapid Transport System (MRTS).
- “DMRC’s Representative” mean such persons appointed by DMRC to act as Engineer for the purpose of the MRTS.
- “BEML” means the Contractor to procure the Couplers and Draft Gear for DMRC RS-15 Cars.
- “Supplier” means the Supplier of Couplers and Draft Gear to BEML for DMRC RS-15 Cars.
- “PTS” means BEML’s Procurement Technical Specification.

2.2. Abbreviations

The following abbreviations shall apply to the PTS, ERGS and ERTS.

ERGS: DMRC RS-15 Employers Requirement General Specification

ERTS: DMRC RS-15 Employers Requirement Technical Specification

	Procurement Technical Specification of Couplers and Draft Gear for DMRC RS-15 Project	Doc. No.	GR/TD/2087
		Date	10.03.2020
		Rev. No.	2
		Page No.	9/24

PTS: BEML Procurement Technical Specification

3. Precedence of Documents

The PTS shall be read in conjunction with the Commercial Specification, ERGS and ERTS.

To the extent that any provision of the PTS is inconsistent with any provisions of the Commercial Specification, the provisions of the Commercial Specification shall prevail.

To the extent that any provision of the Commercial Specification is inconsistent with any provisions of the ERGS and ERTS, the provisions of Commercial Specification shall prevail.

In the event of any conflict between the requirements of particular parts of this PTS, the supplier shall seek clarification from BEML.

Order of precedence	Document Title
1	Commercial Specification
2	PTS
3	ERGS, ERTS


4. Scope of work

4.1. General

The supplier shall be responsible for the scope of works of the couplers and draft-gear, which shall comprise, unless specifically excluded, the design, manufacture, testing, delivery, commissioning and rectification of defects during the Defects Liability Period & associated equipment necessary to facilitate operation and maintenance of couplers and draft-gear which includes special tools and testing equipment, spare parts, operation and maintenance manual and training.

4.2. Design

The design shall meet the requirements of the ERGS and ERTS of RS-15 along with all approved/would be approved variations, modifications and Hardware /

	Procurement Technical Specification of Couplers and Draft Gear for DMRC RS-15 Project	Doc. No.	GR/TD/2087
		Date	10.03.2020
		Rev. No.	2
		Page No.	10/24

Software Engineering Change Proposals that are/ may be implemented in contract 'RS1,RS6 and RS13' cars inline with ERTS as per Appendix -TH of ERTS.

The design shall ensure efficient operation, easy maintenance, correct function and interfaces between the unit end couplers .

4.3. Handing over of couplers

The supplier shall hand over the complete couplers and draft-gear and the component to BEML in accordance with the delivery schedule of BEML.

The supplier shall provide the instruction for proper storage, handling and logistic functions of components supplied by the supplier.

5. Scope of Supply


The Supplier shall meet the system requirements for Couplers and Draft Gear in accordance with Clause 4.10 of RS-15 ERTS, as a minimum.

The Draft gear design and energy absorption shall comply with Clause 4.8 of ERTS. The energy absorption calculation shall be submitted along with offer.

The supplies shall be compatible with the existing DMRC RS1 , RS6 & RS13 rolling stock fleet for operating 6 cars & 8 car train formation. The software compatibility for operation of 6 & 8 car formations shall also be executed by the Supplier.

The Supplier shall provide in line with RS1, RS6 & RS13, as a minimum and also ensure compatibility and inter-changeability with the existing RS1, RS6 & RS13 rolling stock.

The coupler and draft gear supplies shall incorporate all approved/ would be approved variations, modifications and Hardware/ Software Engineering Change Proposals that are and may be implemented in contract RS-1, RS6 and RS-13

	Procurement Technical Specification of Couplers and Draft Gear for DMRC RS-15 Project	Doc. No.	GR/TD/2087
		Date	10.03.2020
		Rev. No.	2
		Page No.	11/24

cars in line with ERTS as per Appendix -TH of ERTS.

5.1. Hardware

Supplier shall provide all components related to coupler and draft-gear, but not limited to, the following:

1) Intermediate Automatic coupler assembly allowing automatic mechanical, electrical and pneumatic coupling and uncoupling of units: (Refer to ERTS 4.10)

- Mechanical coupler head
- Electrical coupler: with electrical contacts of the followings:

a) 130 contacts x 2 for min. 25A

No. of Silver contacts and Gold contacts are given below:


Details	E-Coupler Head
Silver pins / contacts	84 Nos. x 2
Gold pins / contacts	46 Nos. x 2
Dummy pins / contacts	-
Total pins / contacts	130 Nos. x 2

b) Pins requirement for X1, X2 Connector

The supply of Silver pins and Gold pins shall be as per below table:

Connector	Male Pins	Female Pins
X1 Connector Set(Silver Pins)	100 Nos.	100 Nos.
X2 Connector Set(Gold Pins)	60 Nos.	60 Nos.

- Manual uncoupling device for electrical coupler: 1 set per unit.
- Coupler shank with shock absorber
- Pneumatic uncoupling cylinder and Manual uncoupling device.
- Air pipe connections for MRP, BP and Uncoupling pipe.
- Electric head operating gear, pneumatically.
- Gangway support system: to be incorporated into the automatic couplers.
- Self-centering device.
- Vertical support.
- Automatic protection device of electrical contacts and pneumatic connections.
- Connecting cable, protection tube and clamps & cleats for securing the connecting cables and air hoses into the coupler.
- Requisite Mounting fasteners for mounting the coupler to the car body.
The fasteners shall be Geomet coated.
- Plug and receptacle for cable connections to side wiring.
- Earth Cables for earthing from the coupler to the carbody and for the electrical connection between two couplers.

	Procurement Technical Specification of Couplers and Draft Gear for DMRC RS-15 Project	Doc. No.	GR/TD/2087
		Date	10.03.2020
		Rev. No.	2
		Page No.	12/24

- **All Earth cables must be tinned.**
- Required accessories to meet coupler requirements.
- Ring clamp & chains to hang the cables from the shaft

NOTE: The cable length is approximately 3m (as provided in RS-1)

❖ **Following Design improvement shall be taken for DMRC RS15 project.**

Cleat arrangement for conduits of couplers must be properly aligned or installed so that the conduits shall not rub with cocks of electric head operating cylinder and cleat shall not come out from its original position

2) Semi-permanent coupler assembly: (Refer to ERTS 4.10)

- Coupler shank
- Air pipe connections for MRP and BP
- Draft-gear including energy absorption feature
- Gangway support system
- Earth Cables for earthing from the coupler to the carbody
- **All earth cables must be tinned**
- Mounting bracket and all fixings
- Required accessories to meet coupler requirements
- Requisite Mounting fasteners for mounting the coupler to the car body
The fasteners shall be Geomet coated.
- Muff coupling for each unit of M+T car.
- Self-centering device with vertical support in line with RS-1 cars.

3) Name plates & Labels.


The name plates and labels shall be provided as specified in TS 14.17.

Shear off bushes & cable receptacles which are to be installed at carbody side shall be delivered as requested by BEML prior to delivery schedule.

NOTE: Supplies shall be in line with the supplies of DMRC RS1, RS6 and RS13 cars.

5.2. Supply of Spares

The Supplier shall supply the following spares, as per Chapter 8 ERGS. The supplier shall ensure supply of spares for atleast 10 years from the date of completion of the contract.

	Procurement Technical Specification of Couplers and Draft Gear for DMRC RS-15 Project	Doc. No.	GR/TD/2087
		Date	10.03.2020
		Rev. No.	2
		Page No.	13/24

- (i) Unit Exchange Spares
- (ii) Consumables spares
- (iii) Mandatory spares.

5.2.1. Unit Exchange Spares

The supplier shall supply Unit exchange spares required for 1 train sets, i.e, consisting of 1 No. of Intermediate Automatic coupler with E-head and 1 No. of Semi-permanent coupler complying with this PTS.

5.2.2. Consumable Spares

The supplier shall supply Consumable spares for maintenance of all trains during commissioning, service trials and up to completion of warranty period as per ERGS - Clause 8.3.


The consumable spares shall include lubricants, oils, grease, sealants, filter media, gaskets and any other items, whose declared life is less than one year.

The supplier shall supply following consumables spares, as a minimum.

Sl. No.	Description	Unit	Qty in units
	Greases		
1	Grease : Anti corrosive Zinga	Kg	5
2	Grease : (For heavily accessible greasing points)	Kg	5
3	Grease- Terminal grease	Kg	0.2
	Gaskets		
1	Gasket -1 (Voith part no. TSK.171906 10 0)	No.	16
2	Gasket -2 (Voith part no, TSK 171903 10 0)	No.	4
3	Gasket -3 (Voith part no, TSK 103356 10 0)	No.	4
4	Gasket -4 (Voith part no, TSK 976004 10 0)	No.	16

5.2.3. Mandatory Spares

The supplier shall supply Mandatory spares as per ERGS - Clause 8.4, as a

	Procurement Technical Specification of Couplers and Draft Gear for DMRC RS-15 Project	Doc. No.	GR/TD/2087
		Date	10.03.2020
		Rev. No.	2
		Page No.	14/24

minimum, the following items.

Sl. No.	Description	Unit	Qty
1	Proximity sensor	No.	1
2	Set of Pneumatic hoses (for T+M) Set of Pneumatic hoses (Pressure hose 1", Pressure hose 1", pressure hose 3/8") and any other hose (quantity as required for 1 unit (T+M) with all parts & accessories, duly tested and ready to fit and use.	Set	1

Please note "Set" above means items and quantity required for 1 unit (T+M)

5.2.4. Commissioning and DLP Spares

The supplier shall supply commissioning and DLP spares as per ERGS - Clause 8.11

Supplier shall submit to BEML/DMRC for review a list of minimum spare parts that he intends to make available during the installation, erection, and commissioning and defect liability periods.


The supplier shall keep on site, at this own cost, throughout the installation, erection, commissioning and defect liability periods, stocks of spare parts, as per the list to enable rapid replacement of any item found to be defective or in any way in non-conformance with the specification.

Spares as per the agreed list shall be supplied at least three months before receipt of first coupler assembly.

5.3. Interface Responsibilities

The location of mounting points and the design of equipment installation comprising of couplers and draft-gear shall be defined by the supplier and approved by BEML in order to avoid the mechanical interference with other equipment for the vehicle. The supplier shall be responsible for mounting method and providing all requisite materials for mounting on the carbody.

Any changes of the components comprising of Couplers and draft-gear shall be

	Procurement Technical Specification of Couplers and Draft Gear for DMRC RS-15 Project	Doc. No.	GR/TD/2087
		Date	10.03.2020
		Rev. No.	2
		Page No.	15/24

defined by the supplier and approved by BEML in order to avoid the mechanical interference with other equipment for the vehicle.

BEML shall be responsible for defining the technical requirements and the design constraints. The supplier shall be responsible for the design of the Couplers and draft-gear and the submission of design information, the performance of testing activities and the supply, installation and commissioning of Couplers and draft-gear, and the maintenance and rectification of the Couplers and draft-gear during the defects liability period, etc.

The supplier shall provide all mounting/dismounting instructions for the couplers and draft-gear.

5.4. Weight

The weight of all coupler assembly shall be inline with that of RS1/RS6/RS13 couplers. The supplier shall submit details of weight and center of gravity for coupler assembly.


5.5. Quality Assurance Program

5.5.1. General

The supplier shall hold ISO 9001 certification and shall manufacture the product accordingly. The supplier shall submit a copy of ISO 9001 certification along with the offer. The supplier shall monitor and control the Quality systems as per ISO 9001 guidelines. BEML and/or DMRC's representative may periodically conduct compliance audits of the Supplier's Quality management system.

5.5.2. Quality assurance plan

The supplier shall develop and submit a Quality assurance plan (QAP) to BEML for review and approval based on ISO 9001 guidelines.

	Procurement Technical Specification of Couplers and Draft Gear for DMRC RS-15 Project	Doc. No.	GR/TD/2087
		Date	10.03.2020
		Rev. No.	2
		Page No.	16/24

5.6. RAMS requirements

The supplier shall meet RAMS (Reliability, Availability, Maintainability and Safety) requirements given in the ERTS and ERGS. Also, the supplier should provide all information related to the RAMS requirements. The supplier shall comply with, but not limited to, the following requirements:

5.6.1. Reliability Analysis

The reliability data shall be based on actual operating information for the equipment.

In addition, the supplier shall submit a list of typical train withdrawal scenarios for review and acceptance by the BEML. The list shall include all anticipated failure scenarios, which can affect safety, punctuality and passenger comfort. Also, a list of typical train withdrawal scenarios should be based on the reliability analysis.


The reliability block diagrams and prediction of reliability performance shall be submitted to BEML for acceptance.

The reliability block diagrams shall include all elements essential to the successful performance of the system and the interrelationships and interface of these elements.

The supplier shall submit reliability prediction to demonstrate by quantitative methods above the achievement of the specified levels of reliability for the scope of supply.

5.6.2. Reliability Target

The MDBCF (Mean Distance between Component Failure) per 6 or 8 car train-set of Couplers and Draft Gear shall meet the following table, considering 150,000 train-km of annual running mileage as per clause 2.8.2 of ERTS.

	Procurement Technical Specification of Couplers and Draft Gear for DMRC RS-15 Project	Doc. No.	GR/TD/2087
		Date	10.03.2020
		Rev. No.	2
		Page No.	17/24

	After 4 months of start of revenue service MDBCF(train-km)	After 12 months of start of revenue service MDBCF(train-km)
Automatic couplers	4,600,000	6,200,000
Semi permanent couplers	7,000,000	9,400,000

The reliability performance shall be assessed by the following measure:

$$\text{MDBCF} = \frac{\sum \text{Traveled kilometer per train-set}}{\sum \text{Number of Service Failures}}$$

Where, Mean Distance between Component Failure (MDBCF): The MDBCF of a system is the ratio of the total operating distance accumulated by the total population of identical items in the available fleet of the trains to the total number of Service failures occurring within the population identical items.


Service Failure: Any relevant failure or combination of relevant failures during revenue service operations, simulated revenue operations, or during pre-departure equipment status checkouts to determine availability for revenue service, which results in one of the following:

- Unavailability of the train to start revenue service after successful completion of pre-departure checkout.
- Withdrawal of the train from revenue services.
- A delay equivalent to or exceeding 3 minutes from the Schedule / Time table as noted at the destination station for the one way trip.

5.6.3. Maintainability Requirements

5.6.3.1. Design requirements

The design of all components will be such that maintenance is reduced to a minimum, substantially improving service intervals and components will be so arranged that those requiring attention are easily accessible, and readily

	Procurement Technical Specification of Couplers and Draft Gear for DMRC RS-15 Project	Doc. No.	GR/TD/2087
		Date	10.03.2020
		Rev. No.	2
		Page No.	18/24

removable. All equipment should be designed using the Least Replacement Unit (LRU) principle whereby the repair of a fault merely involves the replacement of a faulty module.

The design shall also minimize mean time to repair (MTTR) and costs throughout design life. MTTR is the ratio of cumulative time, including the access time expended during a time interval to the total number of relevant failures.

The supplier shall also comply with the maintenance requirement of ERTS Clause - 2.12.

5.6.3.2. Maintainability Target

- 1) The LRU replacement should be less than 30 minutes.
- 2) The mean time to repair (MTTR) of Couplers and Draft Gear components shall be less than 3 hours.
- 3) Corrective Maintenance Operation that does not require a car lifting shall be less than 4 hours.
- 4) Corrective Maintenance Operation that does require a car lifting shall be less than 6 hours.


5.6.3.3. Master Maintenance schedule

The maintenance schedules will be provided stating the parts needing attention at the basic service period and for major overhauls.

The supplier shall submit work instructions/manuals for all scheduled maintenance activities, fault finding, and corrective maintenance of all faults likely to be found during maintenance and servicing.

5.6.4. Life Cycle Costs

The supplier shall provide equipment that has minimum total Life Cycle Cost. The supplier shall submit Life Cycle Cost calculation in accordance to Clause - 2.25 of ERTS.

	Procurement Technical Specification of Couplers and Draft Gear for DMRC RS-15 Project	Doc. No.	GR/TD/2087
		Date	10.03.2020
		Rev. No.	2
		Page No.	19/24

5.6.5. Reliability and Maintainability Demonstrations

During Defects Liability Period, the values of the R&M target shall be calculated from the records of all faults and service failures. In the event that the R&M target is not achieved, the supplier shall, at his own expense, take whatever action to meet the R&M target specified.

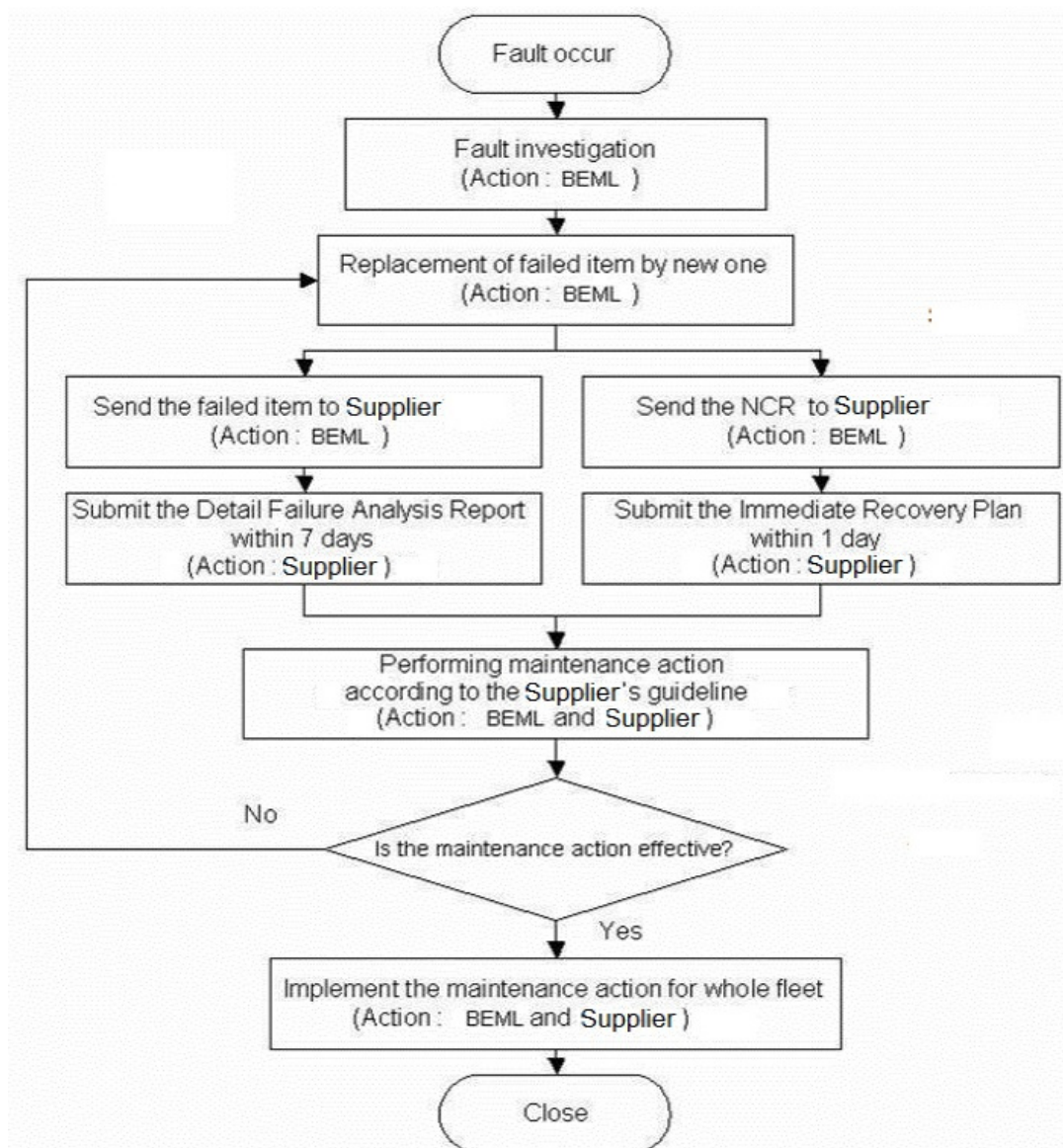



Figure1. Maintenance Procedure of BEML

	Procurement Technical Specification of Couplers and Draft Gear for DMRC RS-15 Project	Doc. No.	GR/TD/2087
		Date	10.03.2020
		Rev. No.	2
		Page No.	20/24

The supplier shall support an active A/S for high availability. The A/S procedure of BEML is same as figure1. Therefore, the supplier should comply with BEML's procedure. If some failure needs the supplier's support, the supplier should dispatch engineer as soon as possible. Also, if the supplier needs some training for BEML's maintenance Engineer, the supplier shall perform it.

5.6.6. Safety Requirements

The supplier shall submit safety assurance plan for Couplers and Draft Gear. This shall cover design, manufacture, testing, commissioning of the system. This shall also indicate features minimizing the magnitude and seriousness of events or malfunctions, which could result in injury to passengers and damage to the equipment but cannot be completely eliminated.

To meet the safety requirement, the Supplier shall submit the following documentations as a minimum.


- 1) System safety assurance plan as per clause 2.4 of ERTS.
- 2) Hazard Analysis including sub-system Hazard Analysis, operating and support hazard Analysis and interface hazard analysis as per clause 2.5 of ERTS.
- 3) FMECA (Failure Mode, Effects and Criticality Analysis)
- 4) Fault Tree Analysis (FTA) for Safety Critical Events

The supplier shall meet RAMS (Reliability, Availability, Maintainability and Safety) requirements given in the ERTS Clause -2.7

5.6.7. RAMS Deliverables

The supplier shall submit the following RAMS Deliverables.

- 1) Product Breakdown Structure during Preliminary Design Stage.
- 2) Reliability Analysis including a list of typical train withdrawal scenarios, Reliability Block Diagram and Reliability Prediction during both Pre-final Design Stage and Final design Stage.
- 3) Preventive and Corrective Maintenance Analysis during both Pre-final Design Stage and Final design Stage.

	Procurement Technical Specification of Couplers and Draft Gear for DMRC RS-15 Project	Doc. No.	GR/TD/2087
		Date	10.03.2020
		Rev. No.	2
		Page No.	21/24

- 4) Hazard Analysis including Subsystem Hazard Analysis, Operating and Support Hazard Analysis and Interface Hazard Analysis during both Pre-final Design Stage and Final design Stage.
- 5) FMECA (Failure Mode, Effects and Criticality Analysis) during both Pre-final Design Stage and Final design Stage.
- 6) Life Cycle Cost Analysis during Final design Stage
- 7) Safety FTA during Final design Stage.

5.7. Fire Safety

5.7.1. General

All non-metallic materials used in the construction of coupler assembly shall be selected to reduce to the maximum extent practical the heat load, rate of heat release, propensity to ignite, rate of flame spread, smoke emission and toxicity of combustion gases.


All non-metallic materials used in the coupler assembly shall comply with fire safety requirements of EN45545 (Hazard level HL3)-latest editions, as per ERTS 2.5.8.

5.7.2. Wire and cables

All wires & cables shall comply to ERTS Clause -12.5

The insulation of all wires and cables including those used within equipment / subsystem shall be halogen-free flame- retardant and formulated to minimize generation of smoke, noxious emissions and corrosive fumes, in the case of overheating or fire in compliance with EN 45545 HL3 latest editions.

Cables shall all comply NF F 63-808 (for low voltages, and NF F 63-826 (for high voltages) or other international standards like EN 50264 (part 1 to 3) and EN 50306 (Part 1 to 4) as approved by the Engineer.

	Procurement Technical Specification of Couplers and Draft Gear for DMRC RS-15 Project	Doc. No.	GR/TD/2087
		Date	10.03.2020
		Rev. No.	2
		Page No.	22/24

The Cable Markers provided shall be fire retardant heat shrinkable type. The cable markers shall be protected against fading by providing Fire retardant heat shrinkable clear sleeves.

5.8. Interfaces with other systems

5.8.1. General

The supplier shall comply with interface management plan according to ERGS- Clause 2.3 and the requirements specified in ERTS- Clause 2.2.

5.8.2. TIMS Interface

The supplier shall comply with the interface requirements with TIMS system


5.8.3. Control Interface

The supplier shall comply with the interface requirements with propulsion system

5.9. Design Submission

The supplier shall submit, all necessary documents viz., Design calculation, Design reports and Design drawings, but not limit to, the following .

- 1) General Assembly, Installation and detail Component drawings of Coupler and Draft-gear in CAD format.
- 2) 3D model of component/equipment in any of the neutral format
- 3) Technical description document for each type of Coupler
- 4) Strength calculation for Coupler & Draft Gear
- 5) Collision Energy absorption calculation
- 6) The Simulation/analysis report regarding the coupler's coupling ability on curves and meeting clause 4.10.2 of ERTS.
- 7) Test procedure and report for Type and Routine test
- 8) Fire safety test reports
- 9) FAI procedure and report

	Procurement Technical Specification of Couplers and Draft Gear for DMRC RS-15 Project	Doc. No.	GR/TD/2087
		Date	10.03.2020
		Rev. No.	2
		Page No.	23/24

All drawings, calculations and design documents shall be submitted in English language.

5.10.Operation & Maintenance Manual

The supplier shall provide three (3) kinds of manuals i.e. Operation manuals, Maintenance manuals with illustrated spare Parts catalogue and technical description manuals. The supplier shall conform to ERGS- Clause 12.

The Supplier shall provide one original and 5 colored copies each of the final O/M manuals in English as well as in electronic format.

5.10.1. Electronic manuals

The Supplier shall provide manuals in electronic format. This is in addition to the submission of manuals in hard copies.

6. Testing


6.1. General

The supplier shall provide BEML with all information for the completion of Inspection, Testing and Commissioning Plan and also comply with the plan defined according to the requirements specified in ERGS - Clause 7 and ERTS -Clause 15.

6.2. Type Test & Routine Test, Coupler System

The Couplers and Draft Gear shall be type and routine tested in accordance with relevant standard and specifications in Contractor/supplier's factories.

All such tests shall be carried out at the supplier's cost, wherever performed, in the presence of and to the satisfaction of BEML and DMRC, who reserves the right to witness any or all of the tests and to require submission of any or all test specifications and reports. BEML and DMRC reserve the right to reasonably call for additional tests, if necessary.

	Procurement Technical Specification of Couplers and Draft Gear for DMRC RS-15 Project	Doc. No.	GR/TD/2087
		Date	10.03.2020
		Rev. No.	2
		Page No.	24/24

6.3. First Article Inspection (FAI)

Before taking up mass production, the Supplier shall offer the first set of Coupler assembly for First Article Inspection by BEML/DMRC. After clearance from BEML, mass production shall be taken up

7. Appendices

1. ERGS of RS-15
2. ERTS of RS-15

8. Submittals with Technical Offer

The Supplier shall provide as a minimum, the following along with the technical offer:

1. Complete Technical Offer for Couplers and Draft Gear
2. Technical description document of coupler assembly
3. Drawings (in .dwg/dxf format) and 3D CAD model of coupler assembly
4. Clause-wise compliance for PTS Doc No. GR/TD/2087
5. Clause-wise compliance to ERTS & ERGS
6. Confirmation to Appendix TH of ERTS
7. List of DLP & Commissioning spares inline with ERGS Chapter 8.