Spoornet Technical: Evaluation, Acquisition and Review			
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DOCUMENT REVISION SHEET

Rev	Section	Description	Date
Draft 00	All	Initial Draft by NYAB/KB and Wabtec	6/26/06
Draft 01	All 5, 6.2.1	General update by NYAB/KB and Wabtec Added Limited BP Emulation by NYAB/KB and Wabtec	9/19/06
Draft 02			14/11/06
Draft 03			5/06/08
04	Appendix A	BCP as discussed with Knorr	11/06/2008
5	Appendix A	BCP as discussed with Knorr/Wabtec	13/06/2008
6	Appendix A, 3.2, 5.2 bullet 6	Pneumatic emergency empty brake cylinder pressures revised with green L1 valve with stiffer spring. EOT's can be supplied with red marker lights. In emulation mode with two cars pneumatically cut out, the emergency application must take effect on all 24 cars	22/06/2009

INTRODUCTION

1.1 Scope

Spoornet will introduce ECP-WDP on certain trains, starting with the coal export line, and later spreading to other lines. Spoornet envisages that the Coal line implementation will become a standard throughout Spoornet.

ECP and WDP systems for Spoornet shall therefore meet the interoperability requirements of the AAR S-4200 series specifications. In addition, the Spoornet Rolling Stock requires ECP and WDP features beyond the limitations of the AAR specifications. These additional features are identified separately as either "Spoornet-Specific Extensions for ECP" or as "Spoornet-Specific Extensions for WDP".

This document describes the "Spoornet-Specific Extensions for ECP". The WDP additional features are documented in the separate H.3 specification. This document therefore describes:

- Interoperability issues to be considered on each implementation of ECP
- The Spoornet –Specific Extensions

The interoperability requirements detailed here are limited to the interaction of wagons (railcars) and locomotives communicating on the ITC Network utilizing "Echelon PL-20 Technology" via ECP communication messages.

1.2 Applicable Documents

In the event of conflict between the AAR S-4200 series documents and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

In the event of conflict between this document and the specification for a new implementation on a different loco class, the contents of this specification shall be considered a superseding requirement until Spoornet resolves the conflict.

Ref	Document Title	Document Number	Custodian
1	Performance Requirements for Electronically Controlled Pneumatic (ECP) Cable-Based Freight Brake Systems	S-4200, version 3.0, revised 2004	AAR
2	Performance Specification for ECP Brake System Cable, Connectors and Junction Boxes	S-4210, version 1.1, revised 2002	AAR
3	Performance Specification for ECP Brake DC Power Supply	S-4220, version 2.0, revised 2002	AAR
4	Intra-Train Communication Specification For Cable-Based Freight Train Control Systems	S-4230, version 3.0, revised 2004	AAR
5	Performance Requirements for ITC Controlled Cable-Based Distributed Power	S-4250, version 2.0, revised 2004	AAR
6	WDP Interoperability Information and Requirements for	RT/TE/SPC/0141	Spoornet

Ref	Document Title	Document Number	Custodian
	Spoornet Locomotives, H3_SPC-0141 Rev 11 (Final)		

1.3 Common Terms

Consist - A contiguous series of locomotives, which may be controlled as a unique group. Locomotive consists can be either Lead consists or Remote consists. Lead consists contain the Lead locomotive and any Trail locomotives that are coupled to it and controlled via the conventional MU connector and pipes. Remote consists contain one ITC Controlled unit and any trail locomotives that are coupled to it and controlled via the conventional MU connector and pipes. Nominally, consists are separated by some number of freight wagons. However, this definition allows back to back multiple consists made of single locomotives provided the MU connector and pipes are not mated between each.

Conventional Lead Unit - The locomotive positioned at the front of a train from which the operator drives. This unit is responsible for generating conventional mode commands to conventional trail locomotives.

Conventional Trail Unit - A locomotive physically coupled in the consist, but not the conventional lead unit, ITC Controlled unit nor ITC Monitored unit. Conventional Trail units receive commands via the MU electrical cables and pneumatic hoses.

Freight Car - Railroad car (wagon) designed to carry freight by rail.

Locomotive (Loco) - A self-propelled unit of railroad equipment designed to be used in train service for moving other railroad rolling equipment (i.e. locomotives, freight cars)

Train - A combination of locomotive(s), consist(s) and/or freight wagon(s), physically coupled together.

Wagon - Freight car

1.4 Common Abbreviations

AAR - Association of American Railroads

BC - Brake Cylinder pressure [kPa]

BP - Brake Pipe Pressure [kPa]

BP Flow - Brake Pipe flow [psid]

CCD - Car Control Device

EAB/EBR - Electronic Air Brake System / Electronic Brake Rack - A conventional locomotive pneumatic air brake control system that is controlled by a microprocessor based system.

ECP - Electrically Controlled Pneumatic Brake system as defined in AAR specifications S-4200 and S-4230.

EOT - End of Train Device

ER - Equalizing Reservoir pressure [kPa]

HEU - Head End Unit – Module used as the controller in an ECP brake system as defined in S-4200. Resides in the lead locomotive of a train.

IDM - Identification Module

ITC - Intra Train Communications (ITC) system specifically designed for ECP freight braking and WDP locomotive control as defined in AAR S-4200 series specifications.

Kg - kilograms

km/h - Kilometers per Hour

kPa - Kilo-Pascals

mm - millimeters

MMI Man-Machine Interface that provides the input control, feedback display and alarm mechanisms to the train operator.

MR - Main Reservoir pressure [kPa]

T/L - Train-line

2. GENERAL OPERATING REQUIREMENTS

2.1 Interoperability

Spoornet operates various classes or types of wagons and locomotives. All wagons and locomotives fitted with ECP brake systems shall be interoperable via the ITC Network unless specifically ordered otherwise. The ECP system shall be capable of inter-operating with mixed trains of wagon types and locomotive types.

3. ECP SYSTEM DESIGN

3.1 ECP General

The ECP System for the Spoornet Rolling Stock shall be compliant with AAR Specification S-4200 Performance Requirements for Electronically Controlled Pneumatic (ECP) Cable-Based Freight Brake Systems and the Spoornet-Specific Extensions identified within this section.

3.2 SPOORNET-SPECIFIC EXTENSIONS: AAR FEATURES NOT REQUIRED

- The requirement for the ECP EOT to meet FRA rules and AAR S4200 section 3.3.
- The requirement for drain holes in the end-of-car junction boxes (S4210 section 8.2) has been overruled by Spoornet. Drain holes in the junction boxes are not allowed.

3.3 ECP SPOORNET-SPECIFIC EXTENSIONS: NON-AAR FEATURES REQUIRED

The following non-AAR additions are required for proper interoperation of Spoornet Rolling Stock, and are described in detail in Section 4:

- Spoornet requires the CCDs to operate in Limited Brake Pipe Emulation mode.
- Spoornet requires two types of ECP Trainline Power Supplies, one to operate from 74VDC locomotive power source and one to operate from 110VDC locomotive power source (S4220 section 2.1).
- The selection of available lengths for the inter-car cable (S4210 section 8.4) has been modified by Spoornet.
- The requirement to support a minimum of 180 network devices (S4230 section 4.0) has been increased by Spoornet to allow for 200 single wagon trains.

4. DETAILED SPOORNET-SPECIFIC EXTENSIONS

4.1 Vehicle Reporting Mark

4.1.1 Wagons

positions	1	2	3	4	5	6	7	8	9	10	11
	P	K	6	3	0	1	0	0	1	1	
	S	W	6	3	5	5	8	7	1	8	

- **Position 1:** Designate “P” for “Pair” (consisting of a master and a slave wagon) ~~coal wagon~~ or “S” for “Single”
- **Position 2:** Designate “K” for Knorr wagon ECPB equipment or “W” for Wabtec wagon ECPB equipment
- **Positions 3 to 10**: Designates the normal wagon number that is painted on the wagon. Spoornet ~~s~~Sprint and C&W personnel must be aware that for wagons connected in pairs, only the master wagon number will be contained in the “Car I.D.”. The numbers of the wagons will still be painted on the master and the slave wagon and both will exist in Sprint. These~~s~~ positions can be either alpha or numeric characters.
- **Position 11**: Reserved

4.1.2 Locomotive

positions	1	2	3	4	5	6	7	8	9	10	11
	L	K	E	E	1	1	0	0	1		
	L	W	D	E	3	4	5	0	1		
	L	K	D	H	0	7	0	0	1		

- **Position 1:** Designate “L” for locomotive.
- **Position 2:** Designate “K” for Knorr locomotive ECPB/WDP equipment or “W” for Wabtec locomotive ECPB/WDP equipment.
- **Positions 3 to 4**: Designate “EE” = Electric-Electric Locomotive; or “DE” = Diesel Electric Locomotive; or possible in future “DH” = Diesel Hydraulic Locomotive.
- **Positions 5 to 9**: Designate Spoornet normal Locomotive numbers that will never have more than 5 numeric digits necessary. The first two numeric digits identifying the locomotive class type (i.e. 07, 11, 10, etc.) and the last three numeric digits identifying the locomotive ID number.
- **Position 10:** Not used
- **Position 11:** Reserved

4.1.3 Transition Vehicle

positions	1	2	3	4	5	6	7	8	9	10	11
	T	K	9	7	0	1	0	0	0	6	
	T	W	9	7	9	9	9	9	9	7	

- **Position 1:** Designate “T” for transition vehicle.
- **Position 2:** Designate “K” for Knorr transition vehicle equipment or “W” for Wabtec transition vehicle equipment.
- **Positions 3 to 10**: Designates the normal wagon number that is painted on the wagon. Spoornet sprint and C&W personnel must be aware that for wagons connected in pairs, only the master wagon number will be contained in the “Car I.D.”. The numbers of the wagons will still be painted on the master and the slave wagon and both will exist in Sprint. Theses position can be either alpha or numeric characters.
- **Position 11:** Reserved

4.2 Vehicle Type

4.2.1 Wagons

Spoornet Wagon Type	ECP Wagon Type Designator
CCL/R 01 (SMALL Single)	CE01
CCL/R 01 (SMALL Rake or 2)	CE13
CCL/R 02 (SMALL Single)	CE02
CCL/R 02 (SMALL Rake of 2)	CE14
CCL/R 03 (SMALL Single)	CE03
CCL/R 03 (SMALL Rake of 2)	CE15
CCL/R 05	CE05
CCL/R 07	CE07
CCL/R 08	CE08
CCL/R 09	CE09
CCL/R 10	CE10
CCL/R 11	CE11

4.2.2 Locomotive

Current Locomotives

Spoornet Locomotive Type	ECP Locomotive Type Designator
11E	11E0
7E	07E0
7E1	07E1
7E2	07E2
7E3	07E3

Spoornet Locomotive Type	ECP Locomotive Type Designator
7E4	07E4
7E5	07E5
7E6	07E6
10E1	10E1
10E2	10E2
37000	3700
34200	3420
34600	3460
34800	3480
RBCT Shunter GE	RBGE
RBCT Shunter GM	RBGM

Future Locomotives

Spoornet Locomotive Type	ECP Locomotive Type Designator
19E	19E0
40000	4000

4.2.3 Transition Vehicle

Spoornet Transition Vehicle Type	ECP Transition Vehicle Type Designator
n/a	NTV1

4.3 Vehicle Static Information

4.3.1 Wagon Details

- Refer to appendix A

4.3.2 Locomotive Details

- Refer to appendix B

4.3.3 Transition Vehicle Details

- Refer to appendix C

5. Limited Brake Pipe Emulation

5.1 Introduction

1. As stated in the Spoornet Rollout specification section C-2.6.1, the CCD brake pipe limited emulation is expected to be used for haulage of a limited number of wagons (24 wagons) at line speeds by small industrial locomotives at a mine. At the mine emulation will be used as part of taking wagons to and from the loading site. Loaded wagons will then be parked until they are added as part of a normal ECP service~~100 wagon~~ train for haulage in normal ECP service.

    a. It is expected that this emulation function may be used by other Spoornet lines in order to use non-ECP equipped locomotives to switch small cuts of cars from the mainline track into shops or loading sites

    b. Another possible use of emulation would be in order to move cars off the mainline into sidings etc… in the event that certain train wide ECP failures have occurred.

2. It is expected that Spoornet operation rules will need to limit the use of brake pipe limited emulation so that it is not used in long trains or in any length train that travels outside a mine (i.e. port to mine, mine to mine, mine to port). The reason for this is based on the following;
    a. The use of this brake pipe emulation function relies on the CCD staying powered-up using its battery back-up. As will be shown as part of a failure mode effects analysis, when the CCDs battery becomes low it will electrically cut-out and BC will stay released or any BC pressure applied will be released (if BP is not in emergency). This will not be detectable by the train operator, particularly if the brake pipe is in release. If several or all cars have cut-out, the train operator will not know it until a service brake request is made, at which time insufficient braking may be available to stop the train. At this time, the train operator would need to initiate an emergency brake pipe reduction. The CCDs, including any that have cut-out, will then apply BC using its pneumatic back-up brake. The emergency brake can subsequently be released, using the CCD pneumatic back-up, by re-charging the brake pipe.
    b. The requirements in this specification do not attempt to mitigate or address the situation described above (in paragraph 2.a).
    c. It is also expected that Spoornet operation rules will require that a departure type brake test be performed prior to moving the train using emulation

5.2 General

1. The BP emulation function is defined as the CCD providing brake cylinder pressure control using brake pipe pressure to determine the brake commands instead of ECP HEU beacons or ECP fault logic.

2. The CCD's ECP fault logic shall **NOT** be used while in BP Emulation; except any fault logic that may prevent the CCD from providing the emulation function.

3. Each CCD shall enter and exit Emulation mode based only upon its local conditions, there is no interaction with the other CCDs in the train.

4. No undesired emergency applications shall be made during service application or release.

5. An emergency application shall always be available.

6. With any 2 consecutive cars pneumatically cut-out, an emergency reduction made with the brake valve shall cause the remainder of the cars to operate in emergency.

7. The maximum train length for BP emulation shall be defined as 25 cars that have 15.24 meters (50 feet) of brake pipe per car.

8. With a fully charged battery and at normal operating temperatures, a CCD shall be capable of operating in Emulation mode for a minimum of 12 hours.

5.3 Entering BP Emulation

1. A Trainline Energizer Device (TED) will provide a pulse of at least 100 VDC for approximately 8 seconds and will send the communication message (see section 6.2.1) in order to wake-up CCDs and enter BP Emulation. The communication message shall be sent as soon as TED is activated and shall then be sent at least once per second for a minimum of 3 seconds after the 100 VDC pulse is turned off.

2. Each CCD shall enter BP Emulation when it receives a specific communication message from the TED commanding it to do so and HEU beacons are **NOT** being received and brake pipe pressure is less than 34.5 kPa (5 PSI). A CCD shall only enter Emulation mode if it has sufficient battery charge.

3. If the message to enter BP emulation is received from the TED while HEU beacons are being received then BP emulation shall **NOT** be entered and normal ECP operation shall take place.

4. The CCDs may be cut-in or they may be cut-out when the message to enter BP Emulation is received from the TED. As long as HEU beacons are **NOT** being received when the message is received, the CCD shall enter BP Emulation. However, if the message to enter BP emulation is received while the CCD is cut-out due to a fault condition, then BP emulation shall **NOT** be entered.

5.4 BP Emulation

1. The CCD shall use brake pipe pressure in order to determine the brake command (of application or release).

2. BP Emulation shall provide a direct release of brake cylinder pressure. Graduated release of brake cylinder pressure shall **NOT** be provided.

3. It is expected that Spoornet will use a locomotive feed valve (ER) setting of 620 kPa (90 PSI) for this mode of operation. As such, the CCD shall use a fixed feed valve setting of 620 kPa (90 PSI) for calculation of target full-service (179 kPa (26 PSI) brake pipe reduction) brake cylinder pressure. Feed valve settings other than 620 kPa (90 PSI) shall not change the target full-service BC pressure. BP emulation shall not be limited to an ER setting of 620 kPa (90 PSI); however settings lower than this may result in less than the desired brake cylinder pressures and resulting braking ratio levels due to insufficient reservoir pressure.

4. With brake pipe and reservoirs fully charged and the CCD in the brake release state, a minimum service brake application shall occur within 15 seconds of a brake pipe drop at a 2.3 kPa/sec (0.333 psi/sec) rate. Under this condition, a brake application must not occur until brake pipe drops more than 20.7 kPa (3 psi).

5. A brake pipe rise of 13.8 kPa (2 PSI) shall be used to identify a brake release command.

6. Once a brake release command is identified in Emulation mode, the CCD shall wait for the brake pipe to be at least 310 kPa (45 PSI), and the reservoir pressure to be 6/7th (86%) of the highest brake pipe charge achieved but not less than 379 kPa (55 PSI) before releasing the brakes. If another brake pipe reduction is made during the period when a CCD is waiting for the reservoir to recharge, the pending release shall be cancelled and the brakes shall remain applied at a BC pressure no less than the highest pressure achieved since the last release.

7. The control of BC pressure levels shall be based on loaded car weight.

8. The **BP** pressure that is expected for each SPOORNET brake valve handle position is approximately equal to the following;
   a. RUN (release); BP = locomotive feed valve (ER) setting
   b. MIN (min service); BP= 44.8 kPa (6.5 PSI) reduction from any locomotive feed valve (ER) setting
   c. Service zone; variable between MIN and FS
   d. FS (Full-Service); BP = 179 kPa (26 PSI) reduction
   e. OVR (Over reduction); BP =-same as FS
   f. NEUT (Neutral); BP = 0
   g. EMER (Emergency); BP = 0

   NOTES: Through manipulation of the brake valve handle, the BP pressure may be fully variable between OVR and NEUT.

   The pressure throughout and at the end of the specified train may not achieve the full designated pressure due to leakage taper, charging capacity and time.

9. BC pressure target levels during BP Emulation shall be;
   a. RUN (release); BCP = 0
   b. MIN (min service) (once an application is detected, which may be at a reduction that is less than that of a MIN designated above); BCP = 68.9 (10 PSI)
   c. From MIN to FS; variable between MIN and FS
   d. FS (Full-Service); BCP = loaded ECP full service pressure as determined for normal ECP operation

e. OVR (Over reduction); BCP = FS
f. OVR to 241 kPa (35 PSI); BCP = BCP = FS
g. Emergency (241 kPa (35 PSI) to 0); BCP = same as determined for normal ECP operation

10. When in BP emulation mode, the CCD shall use its battery back-up for power.

5.5 Exiting BP Emulation

1. BP emulation shall be exited if HEU beacons and trainline power are received and shall enter ECP mode in accordance with AAR Specification S4200.

2. BP emulation on a car shall be exited automatically when the battery becomes insufficient or upon detection of internal faults.

3. BP emulation shall be exited (the CCD shall cut-out and shutdown normally) if brake pipe decreases from 310 kPa (45 PSI) or greater to less than 34.5 kPa (5 PSI).

4. If brake pipe does not exceed 310 kPa (45 PSI) after entering BP emulation after 1 hour, the CCD shall cut-out and shutdown normally.

6. ITC NETWORK COMMUNICATIONS REQUIREMENTS

6.1 General Messaging Requirements

The ECP system for the Spoornet Rolling Stock shall be compliant with AAR S-4230 Intra-Train Communications Specification for Cable-Based Freight Train Control Systems with the Spoornet-Specific Extensions as identified within this section. The following clauses identify the messaging requirements for the Spoornet-Specific Extensions.

6.2 ECP Spoornet-Specific Extension Messages

The message defined below identifies the AAR message modifications required for Limited BP Emulation and will be sent by the TED as stated in section 5.3.1. These modifications shall be incorporated within current AAR messages as indicated below in **bold text**.

6.2.1 **CCD Dynamic Configuration (0, 10)**

Source:	HEU Lead**, TED**	*Message Rate:*	On change **(or 1 Hz per note C)**
Dest:	CCD	*Service Type:*	ACKD **(or UNACKD per note C)**
Msg Type:	Explicit	*Addressing:*	UNICAST **(or BCAST per note C)**
Msg Code:	0×00	*Data Size:*	4 bytes
Priority:	No		

Description: This message is used to change the configuration of a single CCD during ECP train initialization and normal ECP operations. **It is also sent from the Trainline Energizing Device (TED) to command all CCDs to enter Brake Pipe Emulation mode (see note C).** A command to cut in a CCD should not be sent during CUTOUT mode. Any time **during Normal ECP Mode** that duplicate subnet/node addresses could exist in the train, this message shall be sent using a unique ID as the destination address.

Field Name	Size	Value/Range (Resolution)	Default	Notes
CCD STATUS	1	Bit 0: 0 = Cut-in 1 = Cutout	0	
		Bit 1: 0 = Normal ECP Mode 1 = BP Emulation Mode	0	B
		Bits 2–7: Not Used (set to 0)		

Notes:

B. This field is used to command the CCD to enter BP Emulation Mode. During normal ECP operation, this field shall be set to Normal ECP Mode (0).

C. When this message is sent from the TED to command CCDs to enter BP emulation mode, the Message Rate, Service Type and Addressing shall be set to 1 Hz, UNACKD and BCAST respectively.

6.3 ECP Exception Codes for Spoornet-Specific Extensions

There is currently no Spoornet Specific ECP Extension exception messages required.

Appendix A: WAGON INFORMATION

A1 CE 01 Wagon Details (Small CCL/R 01)

Field Name		***Value Units***	***Desired Value***	***Note***
VEHICLE REPORTING MARK		ASCII Text	Refer to sect. 4.1.1	
WAGON TYPE		ASCII Text	Refer to sect. 4.2.1	
WAGON LENGTH		UNITS IN Meters	~~Tbd~~ ~~Spoornet~~12.07	
NUM AXLES			~~Tbd~~ ~~Spoornet~~4	
EMPTY WEIGHT		UNITS IN kg	20820	
LOADED WEIGHT		UNITS IN kg	78820	
NOMINAL WHEEL DIAMETER		UNITS IN mm	~~Tbd~~ ~~Spoornet~~863	
NET BRAKE RATIO DEFAULT		UNITS IN %	12.6	
Minimum application BC pressure (10%)		UNITS IN kPa	70	
Empty Full Service application BC pressure (100%)		UNITS IN kPa	220	
Empty Emergency application BC pressure (120%)		UNITS IN kPa	264	
Loaded Full Service application BC pressure (100%)		UNITS IN kPa	333	
Loaded Emergency application BC pressure (120%)		UNITS IN kPa	399	
Empty Equalization BC pressure		UNITS IN kPa	270-320	
Loaded Equalization BC pressure – SINGLE WAGON		UNITS IN kPa	433	
Loaded Equalization BC pressure – RAKE of 2 WAGON		UNITS IN kPa	443	

A2 CE 02 Wagon Details (Small CCL/R 02)

Field Name		***Value Units***	***Desired Value***	***Note***
VEHICLE REPORTING MARK		ASCII Text	Refer to sect. 4.1.1	
WAGON TYPE		ASCII Text	Refer to sect. 4.2.1	
WAGON LENGTH		UNITS IN Meters	~~Tbd~~ ~~Spoornet~~12.07	
NUM AXLES			~~Tbd~~ ~~Spoornet~~4	
EMPTY WEIGHT		UNITS IN kg	20820	
LOADED WEIGHT		UNITS IN kg	86820	
NOMINAL WHEEL DIAMETER		UNITS IN mm	~~Tbd~~ ~~Spoornet~~863	
NET BRAKE RATIO DEFAULT		UNITS IN %	12.6	
Minimum application BC pressure (10%)		UNITS IN kPa	70	
Empty Full Service application BC pressure (100%)		UNITS IN kPa	220	
Empty Emergency application BC pressure (120%)		UNITS IN kPa	264	
Loaded Full Service application BC pressure (100%)		UNITS IN kPa	333	
Loaded Emergency application BC pressure (120%)		UNITS IN kPa	399	
Empty Equalization BC pressure		UNITS IN kPa	270-320	
Loaded Equalization BC pressure – SINGLE WAGON		UNITS IN kPa	433	
Loaded Equalization BC pressure – RAKE of 2 WAGON		UNITS IN kPa	443	

A3 CE 03 Wagon Details (Small CCL/R 03)

Field Name		***Value Units***	***Desired Value***	***Note***
VEHICLE REPORTING MARK		ASCII Text	Refer to sect. 4.1.1	
WAGON TYPE		ASCII Text	Refer to sect. 4.2.1	
WAGON LENGTH		UNITS IN Meters	~~Tbd~~ ~~Spoornet~~12.07	
NUM AXLES			~~Tbd~~ ~~Spoornet~~ 4	
EMPTY WEIGHT		UNITS IN kg	20820	
LOADED WEIGHT		UNITS IN kg	78820	
NOMINAL WHEEL DIAMETER		UNITS IN mm	~~Tbd~~ ~~Spoornet~~863	
NET BRAKE RATIO DEFAULT		UNITS IN %	12.6	
Minimum application BC pressure (10%)		UNITS IN kPa	70	
Empty Full Service application BC pressure (100%)		UNITS IN kPa	220	
Empty Emergency application BC pressure (120%)		UNITS IN kPa	264	
Loaded Full Service application BC pressure (100%)		UNITS IN kPa	333	
Loaded Emergency application BC pressure (120%)		UNITS IN kPa	399	
Empty Equalization BC pressure		UNITS IN kPa	270-320	
Loaded Equalization BC pressure – SINGLE WAGON		UNITS IN kPa	433	
Loaded Equalization BC pressure – RAKE of 2 WAGON		UNITS IN kPa	443	

A4 CE 05 Wagon Details (Jumbo CCL/R 05)

Field Name		*Value Units*	*Desired Value*	*Note*
VEHICLE REPORTING MARK		ASCII Text	Refer to sect. 4.1.1	
WAGON TYPE		ASCII Text	Refer to sect. 4.2.1	
WAGON LENGTH		UNITS IN Meters	~~Tbd Spoornet~~12.07	
NUM AXLES			~~Tbd Spoornet~~4	
EMPTY WEIGHT		UNITS IN kg	20250	
LOADED WEIGHT		UNITS IN kg	104250	
NOMINAL WHEEL DIAMETER		UNITS IN mm	~~Tbd Spoornet~~ 915	
NET BRAKE RATIO DEFAULT		UNITS IN %	12.6	
Minimum application BC pressure (10%)		UNITS IN kPa	70	
Empty Full Service application BC pressure (100%)		UNITS IN kPa	220	
Empty Emergency application BC pressure (120%)		UNITS IN kPa	264	
Loaded Full Service application BC pressure (100%)		UNITS IN kPa	435	
Loaded Emergency application BC pressure (120%)		UNITS IN kPa	467 to 522 *	
Empty Equalization BC pressure		UNITS IN kPa	270-320	
Loaded Equalization BC pressure		UNITS IN kPa	467	

* = 467Kpa is the equalization pressure for a fully charged reservoir, and the BCP can vary from 467kPa to less or more depending on reservoir status and time.

A5 CE 07 Wagon Details (Jumbo CCL/R 07)

Field Name		***Value Units***	***Desired Value***	***Note***
VEHICLE REPORTING MARK		ASCII Text	Refer to sect. 4.1.1	
WAGON TYPE		ASCII Text	Refer to sect. 4.2.1	
WAGON LENGTH		UNITS IN Meters	~~Tbd Spoornet~~12.07	
NUM AXLES			~~Tbd Spoornet~~4	
EMPTY WEIGHT		UNITS IN kg	20250	
LOADED WEIGHT		UNITS IN kg	104250	
NOMINAL WHEEL DIAMETER		UNITS IN mm	~~Tbd Spoornet~~ 915	
NET BRAKE RATIO DEFAULT		UNITS IN %	12.6	
Minimum application BC pressure (10%)		UNITS IN kPa	70	
Empty Full Service application BC pressure (100%)		UNITS IN kPa	220	
Empty Emergency application BC pressure (120%)		UNITS IN kPa	264	
Loaded Full Service application BC pressure (100%)		UNITS IN kPa	435	
Loaded Emergency application BC pressure (120%)		UNITS IN kPa	467 to 522 *	
Empty Equalization BC pressure		UNITS IN kPa	270-320	
Loaded Equalization BC pressure		UNITS IN kPa	467	

* = 467Kpa is the equalization pressure for a fully charged reservoir, and the BCP can vary from 467kPa to less or more depending on reservoir status and time.

A6 CE 08 Wagon Details (Jumbo CCL/R 08)

Field Name		*Value Units*	*Desired Value*	*Note*
VEHICLE REPORTING MARK		ASCII Text	Refer to sect. 4.1.1	
WAGON TYPE		ASCII Text	Refer to sect. 4.2.1	
WAGON LENGTH		UNITS IN Meters	~~Tbd Spoornet~~12.07	
NUM AXLES			~~Tbd Spoornet~~4	
EMPTY WEIGHT		UNITS IN kg	20250	
LOADED WEIGHT		UNITS IN kg	104250	
NOMINAL WHEEL DIAMETER		UNITS IN mm	~~Tbd Spoornet~~ 915	
NET BRAKE RATIO DEFAULT		UNITS IN %	12.6	
Minimum application BC pressure (10%)		UNITS IN kPa	70	
Empty Full Service application BC pressure (100%)		UNITS IN kPa	220	
Empty Emergency application BC pressure (120%)		UNITS IN kPa	264	
Loaded Full Service application BC pressure (100%)		UNITS IN kPa	435	
Loaded Emergency application BC pressure (120%)		UNITS IN kPa	467 to 522 *	
Empty Equalization BC pressure		UNITS IN kPa	270-320	
Loaded Equalization BC pressure		UNITS IN kPa	467	

* = 467Kpa is the equalization pressure for a fully charged reservoir, and the BCP can vary from 467kPa to less or more depending on reservoir status and time.

A7 CE 09 Wagon Details (Jumbo CCL/R 09)

Field Name		***Value Units***	***Desired Value***	***Note***
VEHICLE REPORTING MARK		ASCII Text	Refer to sect. 4.1.1	
WAGON TYPE		ASCII Text	Refer to sect. 4.2.1	
WAGON LENGTH		UNITS IN Meters	~~Tbd Spoornet~~12.07	
NUM AXLES			~~Tbd Spoornet~~4	
EMPTY WEIGHT		UNITS IN kg	20250	
LOADED WEIGHT		UNITS IN kg	104250	
NOMINAL WHEEL DIAMETER		UNITS IN mm	~~Tbd Spoornet~~ 915	
NET BRAKE RATIO DEFAULT		UNITS IN %	12.6	
Minimum application BC pressure (10%)		UNITS IN kPa	70	
Empty Full Service application BC pressure (100%)		UNITS IN kPa	220	
Empty Emergency application BC pressure (120%)		UNITS IN kPa	264	
Loaded Full Service application BC pressure (100%)		UNITS IN kPa	435	
Loaded Emergency application BC pressure (120%)		UNITS IN kPa	467 to 522 *	
Empty Equalization BC pressure		UNITS IN kPa	270-320	
Loaded Equalization BC pressure		UNITS IN kPa	467	

* = 467Kpa is the equalization pressure for a fully charged reservoir, and the BCP can vary from 467kPa to less or more depending on reservoir status and time.

A8 CE 10 Wagon Details (Jumbo CCL/R 10)

Field Name		*Value Units*	*Desired Value*	*Note*
VEHICLE REPORTING MARK		ASCII Text	Refer to sect. 4.1.1	
WAGON TYPE		ASCII Text	Refer to sect. 4.2.1	
WAGON LENGTH		UNITS IN Meters	~~Tbd Spoornet~~12.07	
NUM AXLES			~~Tbd Spoornet~~4	
EMPTY WEIGHT		UNITS IN kg	20250	
LOADED WEIGHT		UNITS IN kg	104250	
NOMINAL WHEEL DIAMETER		UNITS IN mm	~~Tbd Spoornet~~ 915	
NET BRAKE RATIO DEFAULT		UNITS IN %	12.6	
Minimum application BC pressure (10%)		UNITS IN kPa	70	
Empty Full Service application BC pressure (100%)		UNITS IN kPa	220	
Empty Emergency application BC pressure (120%)		UNITS IN kPa	264	
Loaded Full Service application BC pressure (100%)		UNITS IN kPa	435	
Loaded Emergency application BC pressure (120%)		UNITS IN kPa	467 to 522 *	
Empty Equalization BC pressure		UNITS IN kPa	270-320	
Loaded Equalization BC pressure		UNITS IN kPa	467	

* = 467Kpa is the equalization pressure for a fully charged reservoir, and the BCP can vary from 467kPa to less or more depending on reservoir status and time.

A9 CE 11 Wagon Details (Jumbo CCL/R 11)

Field Name		*Value Units*	*Desired Value*	*Note*
VEHICLE REPORTING MARK		ASCII Text	Refer to sect. 4.1.1	
WAGON TYPE		ASCII Text	Refer to sect. 4.2.1	
WAGON LENGTH		UNITS IN Meters	~~Tbd Spoornet~~12.07	
NUM AXLES			~~Tbd Spoornet~~4	
EMPTY WEIGHT		UNITS IN kg	20250	
LOADED WEIGHT		UNITS IN kg	104250	
NOMINAL WHEEL DIAMETER		UNITS IN mm	~~Tbd Spoornet~~ 915	
NET BRAKE RATIO DEFAULT		UNITS IN %	12.6	
Minimum application BC pressure (10%)		UNITS IN kPa	70	
Empty Full Service application BC pressure (100%)		UNITS IN kPa	220	
Empty Emergency application BC pressure (120%)		UNITS IN kPa	264	
Loaded Full Service application BC pressure (100%)		UNITS IN kPa	435	
Loaded Emergency application BC pressure (120%)		UNITS IN kPa	467 to 522 *	
Empty Equalization BC pressure		UNITS IN kPa	270-320	
Loaded Equalization BC pressure		UNITS IN kPa	467	

* = 467Kpa is the equalization pressure for a fully charged reservoir, and the BCP can vary from 467kPa to less or more depending on reservoir status and time.

Appendix B: LOCOMOTIVE INFORMATION

B1 7E, 7E1, 7E2, 7E3, 7E4, 7E5, 7E6 Locomotive Details

Field Name		*Value Units*	*Desired Value*	*Note*
VEHICLE REPORTING MARK		ASCII Text	Refer to sect. 4.1.2	
LOCOMOTIVE TYPE		ASCII Text	Refer to sect. 4.2.2	
LOCOMOTIVE LENGTH		UNITS IN Meters	18.43	
NOMINAL MASS		MASS IN kg	125500	
NUM AXLES			6	
NOMINAL WHEEL DIAMETER		UNITS IN mm	1220	
NET BRAKE RATIO DEFAULT		UNITS IN %	12.6	
BP PRESSURE SET POINT		UNITS IN kPa	620	
SUPPRESSION APPLICATION		UNITS IN %	100	
LOW BATTERY FAULT THRESHOLD		UNITS IN vdc	80	
LOW BATTERY FAULT CLEAR THRESHOLD		UNITS IN vdc	90	
Normal independent BC pressure range		UNITS IN kPa	0 to 350	
Minimum application BC pressure (10%)		UNITS IN kPa	70	
Full Service application BC pressure (100%)		UNITS IN kPa	225	
Emergency application BC pressure (120%)		UNITS IN kPa	250	
Continuous traction motor current (100%)		UNITS IN Amps	635	
Motor Current 1 Hour rating (107%)		UNITS IN Amps	680	
Starting Motor Current (139%)		UNITS IN Amps	882	

B2 10E1, 10E2 Locomotive Details

Field Name		*Value Units*	*Desired Value*	*Note*
VEHICLE REPORTING MARK		ASCII Text	Refer to sect. 4.1.2	
LOCOMOTIVE TYPE		ASCII Text	Refer to sect. 4.2.2	
LOCOMOTIVE LENGTH		UNITS IN Meters	18.52	
NOMINAL MASS		MASS IN kg	125000	
NUM AXLES			6	
NOMINAL WHEEL DIAMETER		UNITS IN mm	1220	
NET BRAKE RATIO DEFAULT		UNITS IN %	12.6	
BP PRESSURE SET POINT		UNITS IN kPa	620	
SUPPRESSION APPLICATION		UNITS IN %	100	
LOW BATTERY FAULT THRESHOLD		UNITS IN vdc	80	
LOW BATTERY FAULT CLEAR THRESHOLD		UNITS IN vdc	90	
Normal independent BC pressure range		UNITS IN kPa	0 to 350	
Minimum application BC pressure (10%)		UNITS IN kPa	70	
Full Service application BC pressure (100%)		UNITS IN kPa	350	
Emergency application BC pressure (120%)		UNITS IN kPa	420	
Continuous traction motor current		UNITS IN Amps	Tbd Spoornet	
Motor Current 1 Hour rating		UNITS IN Amps	Tbd Spoornet	
Starting Motor Current		UNITS IN Amps	Tbd Spoornet	

B3 11E Locomotive Details

Field Name		*Value Units*	*Desired Value*	*Note*
VEHICLE REPORTING MARK		ASCII Text	Refer to sect. 4.1.2	
LOCOMOTIVE TYPE		ASCII Text	Refer to sect. 4.2.2	
LOCOMOTIVE LENGTH		UNITS IN Meters	20.43	
NOMINAL MASS		MASS IN kg	170000	
NUM AXLES			6	
NOMINAL WHEEL DIAMETER		UNITS IN mm	1220	
NET BRAKE RATIO DEFAULT		UNITS IN %	12.6	
BP PRESSURE SET POINT		UNITS IN kPa	620	
SUPPRESSION APPLICATION		UNITS IN %	100	
LOW BATTERY FAULT THRESHOLD		UNITS IN vdc	80	
LOW BATTERY FAULT CLEAR THRESHOLD		UNITS IN vdc	90	
Normal independent BC pressure range		UNITS IN kPa	0 to 350	
Minimum application BC pressure (10%)		UNITS IN kPa	70	
Full Service application BC pressure (100%)		UNITS IN kPa	350	
Emergency application BC pressure (120%)		UNITS IN kPa	420	
Continuous traction motor current (100%)		UNITS IN Amps	815	
Motor Current 1 Hour rating (106%)		UNITS IN Amps	865	
Starting Motor Current (144%)		UNITS IN Amps	1170	

B4 37000 Locomotive Details

Field Name		*Value Units*	*Desired Value*	*Note*
VEHICLE REPORTING MARK		ASCII Text	Refer to sect. 4.1.2	
LOCOMOTIVE TYPE		ASCII Text	Refer to sect. 4.2.2	
LOCOMOTIVE LENGTH		UNITS IN Meters	19.20	
NOMINAL MASS		MASS IN kg	125000	
NUM AXLES			6	
NOMINAL WHEEL DIAMETER		UNITS IN mm	1016	
NET BRAKE RATIO DEFAULT		UNITS IN %	12.6	
BP PRESSURE SET POINT		UNITS IN kPa	620	
SUPPRESSION APPLICATION		UNITS IN %	100	
LOW BATTERY FAULT THRESHOLD		UNITS IN vdc	50	
LOW BATTERY FAULT CLEAR THRESHOLD		UNITS IN vdc	60	
Normal independent BC pressure range		UNITS IN kPa	0 to 350	
Minimum application BC pressure (10%)		UNITS IN kPa	70	
Full Service application BC pressure (100%)		UNITS IN kPa	350	
Emergency application BC pressure (120%)		UNITS IN kPa	420	
Continuous traction motor current (100%)		UNITS IN amps	520	
Motor Current 1 Hour rating (105%)		UNITS IN amps	545	
Starting Motor Current (%)		UNITS IN amps	~~Tbd Spoornet~~ 642	

~~B5 34200 Locomotive Details~~

~~Field Name~~		***~~Value Units~~***	***~~Desired Value~~***	***~~Note~~***
~~VEHICLE REPORTING MARK~~		~~ASCII Text~~	~~Refer to sect. 4.1.2~~	
~~LOCOMOTIVE TYPE~~		~~ASCII Text~~	~~Refer to sect. 4.2.2~~	
~~LOCOMOTIVE LENGTH~~		~~UNITS IN Meters~~	~~Tbd Spoornet~~	
~~NOMINAL MASS~~		~~MASS IN kg~~	~~Tbd Spoornet~~	
~~NUM AXLES~~			~~Tbd Spoornet~~	
~~NOMINAL WHEEL DIAMETER~~		~~UNITS IN mm~~	~~Tbd Spoornet~~	
~~NET BRAKE RATIO DEFAULT~~		~~UNITS IN %~~	~~12.6~~	
~~BP PRESSURE SET POINT~~		~~UNITS IN kPa~~	~~620~~	
~~SUPPRESSION APPLICATION~~		~~UNITS IN %~~	~~100~~	
~~LOW BATTERY FAULT THRESHOLD~~		~~UNITS IN vdc~~	~~50~~	
~~LOW BATTERY FAULT CLEAR THRESHOLD~~		~~UNITS IN vdc~~	~~60~~	
~~Normal independent BC pressure range~~		~~UNITS IN kPa~~	~~Tbd Spoornet~~	
~~Minimum application BC pressure (10%)~~		~~UNITS IN kPa~~	~~Tbd Spoornet~~	
~~Full Service application BC pressure (100%)~~		~~UNITS IN kPa~~	~~Tbd Spoornet~~	
~~Emergency application BC pressure (120%)~~		~~UNITS IN kPa~~	~~Tbd Spoornet~~	
~~Continuous traction motor current (100%)~~		~~UNITS IN amps~~	~~Tbd Spoornet~~	
~~Motor Current 1 Hour rating (%)~~		~~UNITS IN amps~~	~~Tbd Spoornet~~	
~~Starting Motor Current (%)~~		~~UNITS IN amps~~	~~Tbd Spoornet~~	

B~~6~~5 34600 Locomotive Details

Field Name		*Value Units*	*Desired Value*	*Note*
VEHICLE REPORTING MARK		ASCII Text	Refer to sect. 4.1.2	
LOCOMOTIVE TYPE		ASCII Text	Refer to sect. 4.2.2	
LOCOMOTIVE LENGTH		UNITS IN Meters	~~Tbd Spoornet~~ 19.2	
NOMINAL MASS		MASS IN kg	~~Tbd Spoornet~~ 111000	
NUM AXLES			~~Tbd Spoornet~~ 6	
NOMINAL WHEEL DIAMETER		UNITS IN mm	~~Tbd Spoornet~~ 1016	
NET BRAKE RATIO DEFAULT		UNITS IN %	12.6	
BP PRESSURE SET POINT		UNITS IN kPa	620	
SUPPRESSION APPLICATION		UNITS IN %	100	
LOW BATTERY FAULT THRESHOLD		UNITS IN vdc	50	
LOW BATTERY FAULT CLEAR THRESHOLD		UNITS IN vdc	60	
Normal independent BC pressure range		UNITS IN kPa	~~Tbd Spoornet~~ 0-350	
Minimum application BC pressure (10%)		UNITS IN kPa	~~Tbd Spoornet~~ 70	
Full Service application BC pressure (100%)		UNITS IN kPa	~~Tbd Spoornet~~ 350	
Emergency application BC pressure (120%)		UNITS IN kPa	~~Tbd Spoornet~~ 420	
Continuous traction motor current (100%)		UNITS IN amps	Tbd Spoornet	
Motor Current 1 Hour rating (%)		UNITS IN amps	Tbd Spoornet	
Starting Motor Current (%)		UNITS IN amps	Tbd Spoornet	

~~B7 34800 Locomotive Details~~

~~*Field Name*~~		~~*Value Units*~~	~~*Desired Value*~~	~~*Note*~~
~~VEHICLE REPORTING MARK~~		~~ASCII Text~~	~~Refer to sect. 4.1.2~~	
~~LOCOMOTIVE TYPE~~		~~ASCII Text~~	~~Refer to sect. 4.2.2~~	
~~LOCOMOTIVE LENGTH~~		~~UNITS IN Meters~~	~~Tbd Spoornet 19.2~~	
~~NOMINAL MASS~~		~~MASS IN kg~~	~~Tbd Spoornet 111000~~	
~~NUM AXLES~~			~~Tbd Spoornet 6~~	
~~NOMINAL WHEEL DIAMETER~~		~~UNITS IN mm~~	~~Tbd Spoornet 1016~~	
~~NET BRAKE RATIO DEFAULT~~		~~UNITS IN %~~	~~12.6~~	
~~BP PRESSURE SET POINT~~		~~UNITS IN kPa~~	~~620~~	
~~SUPPRESSION APPLICATION~~		~~UNITS IN %~~	~~100~~	
~~LOW BATTERY FAULT THRESHOLD~~		~~UNITS IN vdc~~	~~50~~	
~~LOW BATTERY FAULT CLEAR THRESHOLD~~		~~UNITS IN vdc~~	~~60~~	
~~Normal independent BC pressure range~~		~~UNITS IN kPa~~	~~Tbd Spoornet~~	
~~Minimum application BC pressure (10%)~~		~~UNITS IN kPa~~	~~Tbd Spoornet~~	
~~Full Service application BC pressure (100%)~~		~~UNITS IN kPa~~	~~Tbd Spoornet~~	
~~Emergency application BC pressure (120%)~~		~~UNITS IN kPa~~	~~Tbd Spoornet~~	
~~Continuous traction motor current (100%)~~		~~UNITS IN amps~~	~~Tbd Spoornet~~	
~~Motor Current 1 Hour rating (%)~~		~~UNITS IN amps~~	~~Tbd Spoornet~~	
~~Starting Motor Current (%)~~		~~UNITS IN amps~~	~~Tbd Spoornet~~	

B8 RBGE Locomotive Details

Field Name		*Value Units*	*Desired Value*	*Note*
VEHICLE REPORTING MARK		ASCII Text	Refer to sect. 4.1.2	
LOCOMOTIVE TYPE		ASCII Text	Refer to sect. 4.2.2	
LOCOMOTIVE LENGTH		UNITS IN Meters	Tbd Spoornet	
NOMINAL MASS		MASS IN kg	~~Tbd Spoornet~~ 4	
NUM AXLES			Tbd Spoornet	
NOMINAL WHEEL DIAMETER		UNITS IN mm	Tbd Spoornet	
NET BRAKE RATIO DEFAULT		UNITS IN %	12.6	
BP PRESSURE SET POINT		UNITS IN kPa	620	
SUPPRESSION APPLICATION		UNITS IN %	100	
LOW BATTERY FAULT THRESHOLD		UNITS IN vdc	50	
LOW BATTERY FAULT CLEAR THRESHOLD		UNITS IN vdc	60	
Normal independent BC pressure range		UNITS IN kPa	Tbd Spoornet	
Minimum application BC pressure (10%)		UNITS IN kPa	Tbd Spoornet	
Full Service application BC pressure (100%)		UNITS IN kPa	Tbd Spoornet	
Emergency application BC pressure (120%)		UNITS IN kPa	Tbd Spoornet	
Continuous traction motor current (100%)		UNITS IN amps	Tbd Spoornet	
Motor Current 1 Hour rating (%)		UNITS IN amps	Tbd Spoornet	
Starting Motor Current (%)		UNITS IN amps	Tbd Spoornet	

B9 RBGM Locomotive Details

Field Name		*Value Units*	*Desired Value*	*Note*
VEHICLE REPORTING MARK		ASCII Text	Refer to sect. 4.1.2	
LOCOMOTIVE TYPE		ASCII Text	Refer to sect. 4.2.2	
LOCOMOTIVE LENGTH		UNITS IN Meters	Tbd Spoornet	
NOMINAL MASS		MASS IN kg	Tbd Spoornet	
NUM AXLES			~~Tbd Spoornet~~ 6	
NOMINAL WHEEL DIAMETER		UNITS IN mm	Tbd Spoornet	
NET BRAKE RATIO DEFAULT		UNITS IN %	12.6	
BP PRESSURE SET POINT		UNITS IN kPa	620	
SUPPRESSION APPLICATION		UNITS IN %	100	
LOW BATTERY FAULT THRESHOLD		UNITS IN vdc	50	
LOW BATTERY FAULT CLEAR THRESHOLD		UNITS IN vdc	60	
Normal independent BC pressure range		UNITS IN kPa	Tbd Spoornet	
Minimum application BC pressure (10%)		UNITS IN kPa	Tbd Spoornet	
Full Service application BC pressure (100%)		UNITS IN kPa	Tbd Spoornet	
Emergency application BC pressure (120%)		UNITS IN kPa	Tbd Spoornet	
Continuous traction motor current (100%)		UNITS IN amps	Tbd Spoornet	
Motor Current 1 Hour rating (%)		UNITS IN amps	Tbd Spoornet	
Starting Motor Current (%)		UNITS IN amps	Tbd Spoornet	

Appendix C: TRANSITION VEHICLE INFORMATION

C1 Transition Vehicle Details

Field Name		***Value Units***	***Desired Value***	***Note***
VEHICLE REPORTING MARK		ASCII Text	Refer to sect. 4.4.1	
LOCOMOTIVE TYPE		ASCII Text	Refer to sect. 4.4.2	
LOCOMOTIVE LENGTH		UNITS IN Meters	12.19	
NOMINAL MASS		MASS IN kg	~~Tbd Spoornet~~ 78000	
NUM AXLES			4	
NOMINAL WHEEL DIAMETER		UNITS IN mm	~~Tbd Spoornet~~ 864	
NET BRAKE RATIO DEFAULT		UNITS IN %	12.6	
BP PRESSURE SET POINT		UNITS IN kPa	620	
SUPPRESSION APPLICATION		UNITS IN %	100	
LOW BATTERY FAULT THRESHOLD		UNITS IN vdc	Tbd NYAB	
LOW BATTERY FAULT CLEAR THRESHOLD		UNITS IN vdc	Tbd NYAB	
Normal independent BC pressure range		UNITS IN kPa	n/a	
Minimum application BC pressure (10%)		UNITS IN kPa	0	
Full Service application BC pressure (100%)		UNITS IN kPa	0	
Emergency application BC pressure (120%)		UNITS IN kPa	n/a	
Continuous traction motor current (100%)		UNITS IN Amps	n/a	
Motor Current 1 Hour rating (107%)		UNITS IN Amps	n/a	
Starting Motor Current (139%)		UNITS IN Amps	n/a	

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