OTTAWA LIGHT RAIL TRANSIT PROJECT

Reliability, Availability and Maintainability Report

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REVISION HISTORY

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0	12-Feb-2019	Initial Issue	M. Williamson	S. Leonard	J. Blowfield	D. Wynne	S. Derry
1	17-04-2019	Updated initial Issue	M. Williamson	S. Leonard	J. Blowfield	D. Wynne	S. Derry
2	23-May-2019	Revised following CRE comments from the City, received 14/05/2019	M. Williamson	S. Leonard	J. Blowfield	D. Wynne	S. Derry

EXECUTIVE SUMMARY

This report presents the Reliability Availability and Maintainability (RAM) analysis for the Ottawa Confederation Line Phase 1 and supports the Confederation Line Phase 1 Case for Safety [1] and Confederation Line Phase 1 Engineering Safety and Assurance Case [2].

This report has been prepared in accordance with the OLRT RAM Plan [3] and aims to assimilate and develop the parts-count reliability predictions presented in the project RAM Reports [4], [5], [6], [7], [8] with the FMEA modelling FMEA modelling [11], [12], [13], [14], [15], [16] to derive a Railway Level RAM analysis that predicts service availability performance, perturbation levels and can be used as an precursor to the future development and optimisation of the maintenance strategy.

Parts-count have been applied based upon empirical data from standard texts, supplier recommendations, engineering judgment and field data and verified by comparison to the known performance on railway infrastructures elsewhere.

The FMEA modelling performed provides confidence that probability, consequences, detection methods and mitigations in place to protect against associated with prevalent failure modes have been adequately managed.

Availability modelling provides evidence that the Ottawa Confederation Line Phase 1 is capable of achieving an operational service availability of 99.07%. However, this is considered to be based upon conservative assumptions and steady state operational performance is considered to exceed this level.

A series of recommendations are shown in section 10 have been made to maximise the long-term operational performance of the infrastructure.

It is considered that the Ottawa Confederation Line Phase 1 infrastructure is adequately reliable and suitable for the onset of RSA.

CONTENTS

1. INTRODUCTION

This RAM Report presents the output from assessment for the Ottawa Confederation Line Phase 1. It has been conducted in line with the Engineering Joint Venture (EJV) OLRT RAM Plan [3], which in turn, is structured around the principles of EN50126 [19] tailored to the specific requirements of the programme.

Analysis has been performed in order to provide assurance that RAM performance is inherent in the design, Project Agreement (PA) [17] requirements are information to inform the future maintenance strategy.

It has been prepared in readiness for the owner of Trial Running and represents a configuration that is considered to be satisfactorily mature and acceptable for Revenue Service Availability (RSA).

The report sets out to utilise, integrate and develop all relevant RAM evidence generated throughout the project to date and present a body of evidence as a RAM Case in using Goal Structured Notation (GSN) format to justify a series of RAM claims.

The principal sources of RAM data generated by the project comprise:

- RAM Reports
  - Communications (COM) System Reliability, Availability and Maintainability Report [4]
  - Overhead Catenary System Reliability, Availability and Maintainability Report [5]
  - Traction Power System Reliability, Availability and Maintainability Report [6]
  - Tunnel Ventilation System Reliability, Availability and Maintainability Report [7]
  - Station System Reliability, Availability and Maintainability Report [8]
  - Trackworks Reliability, Availability and Maintainability Report [9]
  - CBTC RAM Analysis (Signalling) [10]
- FMEA Reports
  - Communication (COM) Failure Modes and Effects Analysis (FMEA) Report [11]
  - Overhead Catenary System Failure Modes and Effects Analysis [12]
  - Traction Power Failure Modes and Effects Analysis [13]
  - Tunnel Failure Modes and Effects Analysis [14]
  - Station Failure Modes and Effects Analysis [15]
  - Trackworks Failure Modes and Effects Analysis [16]
  - RAM Analysis (CBTC) Report [10]

1.1 PURPOSE

This report has been compiled with the following aims:

- Detail activities undertaken to ensure RAM performance is inherent in the design

- Provide evidence that requirements of the PA [17] are realised in the design
- Provide data to inform the maintenance solution
- Provide confidence in the operational performance of the infrastructure
- Identify opportunities to improve RAM performance.

1.2 SCOPE

1.2.1 Specific Inclusions

The following are within scope of this report:

- RAM assessment in accordance with OLRT RAM Plan [3]
- All geographic locations and stations identified in Section 2.1
- All systems identified in Section 5
- All lifecycle phases and operating modes.

1.2.2 Specific Exclusions

The following are outside of the scope of this report:

- Any systems outside of the Ottawa Confederation Line Phase 1 interface boundary
- Assessment of system safety
- Detailed RAM assessment of rolling stock
- Assessment of failure events due to adverse weather, security events or the actions of passengers
- Detailed maintenance task analysis or evaluation of processes implemented by the maintenance organisation
- Generation of training needs analysis or associated training delivery to maintenance personnel or operators
- Any project related risks that are outside of the RAM discipline.

1.3 DOCUMENT STRUCTURE

This document details the RAM analysis for the Ottawa Confederation Line Phase 1 and forms part of the Confederation Line Phase 1 Case for Safety [1] and the Confederation Line Phase 1 Engineering Safety and Assurance Case [2].

The Ottawa Confederation Line Phase 1 Safety and Assurance framework is shown in Figure 1.

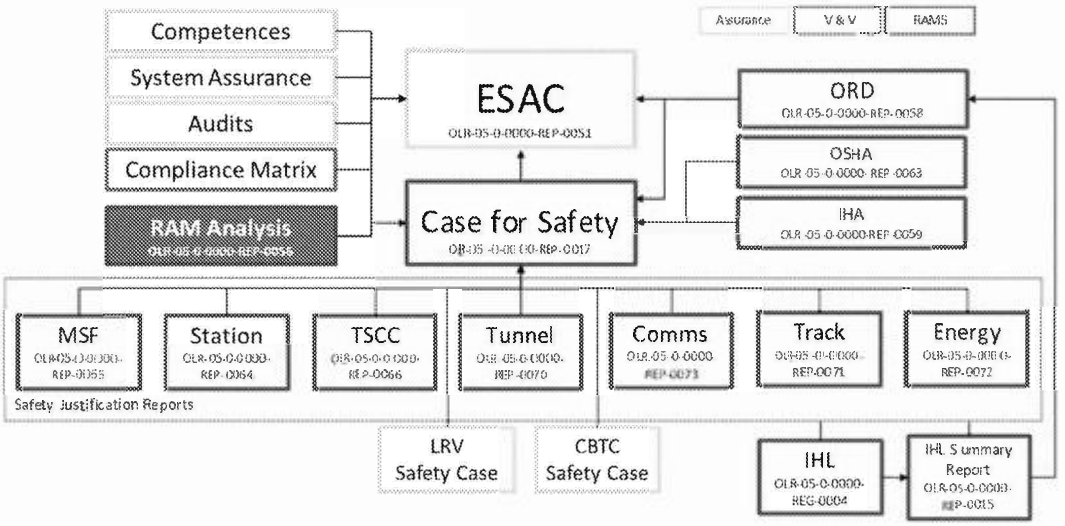

Figure 1: Document Hierarchy

This document is structured as follows:

- Section 1: Defines the purpose, scope and approach to the safety argument together with a review of key reference documents and describes the OLRT project, stakeholders, geographic locations under consideration
- Section 2: Provides a summary of the overall project, procurement strategy and approach to effective service provision through-life
- Section 3: Identification of all functional and non-functional RAM related requirements from the PA [17]
- Section 4: Description of the RAM activities undertaken within this document
- Section 5: Description of the systems under consideration and design provisions implemented to mitigate RAM risk
- Section 6: Identification of any assumptions made in conducting the RAM assessment
- Section 7: RAM Predictions – Output from the reliability prediction as a parts-count analysis
- Section 8: Output from the FMEA modelling activities, including the summery of end effects and failure severity, detection methods for testability assessment, and performance modelling considering the impact of failures upon service delivery performance
- Section 9 and 10: Summarising the overall RAM Case, claims and body of evidence, and the identification of any potential opportunities to improve RAM performance.

1.4 GLOSSARY

Table 1: Acronyms and Abbreviations

Abbreviation	Meaning
AC	Alternating Current
AREMA	American Railway Engineering and Maintenance-of-Way Association
ATIS	Automatic Transmitter Identification System
ATO	Automatic Train Operation
ATP	Automatic Train Protection
ATS	Automatic Train Supervision
BAS	Building Automation System
BCC	Backup Control Centre
CBTC	Communications Based Train Control
CCL	Construction Certification Letter
CCTV	Closed Circuit Television
CDL	Design Certification Letter
COM	Reliability Block Diagram
COTS	Commercial Off The Shelf
CTS	Communications Transmission System
DC	Direct Current
DCS	Data Communication System
DCL	Design Certification Letter
DFF	Direct fixation fastener
DRACAS	Data Recording Analysis and Corrective Action System
EBS	Equipment Breakdown Structure
EER	Electronic Equipment Room
EHFI	Elevator intercoms
EJV	Engineering Joint Venture
ETEL	Emergency telephones
FACP	Fire Alarm Control Panel
FAT	Factory Acceptance Test
FDAS	Fire Detection and Alarm System

Abbreviation	Meaning
FEC	Fibre Entrance Cabinet
FMEA	Failure Modes and Effects Analysis
FPP	Fibre Patch Panel
FR	Failure Rate
FTEL	Firefighter's Telephone
FTEL	Firefighter's Telephone
GF	Ground Fixed
GIDS	GIDS
GIDS	Guideway Intrusion Detection System
GPS	Global Positioning System
GSN	Goal Structured Notation
GUI	Graphical User Interface
HINT	Hands-free intercoms
HMI	Human Machine Interface
HVAC	Heating Ventilation and Air Conditioning
IAC	Intruder Access Control
IEEE	Electrical and Electronics Engineers
IHA	Interface Hazard Analysis
ITEL	Information Telephone
LAN	Local Area Network
LED	Light Emitting Diode
LLRU	Lowest Line Replaceable Unit
LRT	Light Rail Transit
LRU	Line Replaceable Unit
LSRS	Local Schedule Regulation System
MCLK	Master Clock
MIL STD	Military Standard
MIL-HDBK	Military Handbook
MPU	Main Processor Unit
MSF	Maintenance and Storage Facility

Abbreviation	Meaning
MTBF	Mean Time Between Failure
MTBSAF	Mean Time Between Service Affecting Failure
MTEL	Maintenance Telephone
MTTR	Mean Time To Repair
NGD	Negative Grounding Device
NMS	Network Management System
NPRD	Non-Electric Parts Reliability Database
OCL	overhead contact line
OCS	Overhead Catenary System
OEM	Original Equipment Manufacturers
OLRT	Ottawa Light Rail Transit
PA	Project Agreement
PABX	Private Automatic Branch Exchange
PIDS	Passenger Information Display System
PIS	Passenger Information System
PLC	Programmable Logic Controller
PPU	Peripheral Processor Unit
QMP	Quality Management Plan
QMS	Quality Management System
QPS	Quantity of each item per system
QPU	Quantity of each item per unit
RAID	Redundant Array of Independent Disks
RAM	Reliability, Availability and Maintainability
RAMS	Reliability, Availability, Maintainability and Safety
RBD	Reliability Block Diagram
RCM	Reliability Centred Maintenance
RGS	Rail Grounding Switch
RIAC-HDBK	Reliability Information Analysis Centre Handbook
RTU	Remote Terminal Unit
SAT	Systems Acceptance Test

Abbreviation	Meaning
SCADA	Supervisory Control And Data Acquisition
SCAT	Simple Catenary Auto-Tensioned
SDR	Software Defined Radio
SIL	Safety Integrity Level
SIT	Systems Integration Test
SRS	Schedule Regulation System
STEL	Staff telephones
TCMS	Test Control and Monitoring System
TPS	Traction Power Supply
TPSS	Traction Power Substations
TRK	Track
TS	Telephony system
TSCC	Train Service Control Centre
TVM	Ticket Vending Machine
TVS	Tunnel Ventilation System
UBRU	On-Board Radio Unit
UPS	Uninterruptible Power Supply
V&V	Verification and Validation
VFD	Variable Frequency Drive
VIBC	Vehicle On-board Controller
YCC	Yard Control Centre
ZC	Zone Controller

1.5 REFERENCE DOCUMENTS & GOVERNANCE

1.5.1 Reference Project Documents

Project documents referenced within this report are shown in the Table 2. Reference is made to the latest release unless otherwise stated.

Table 2: Referenced Project Documents

	Title	Document No.
[1]	Confederation Line Phase 1 Case for Safety	OLR-05-0-0000-REP-0017
[2]	Confederation Line Phase 1 Engineering Safety and Assurance Case	OLR-05-0-0000-REP-0051
[3]	OLRT RAM Plan	REJ-05-0-0000-REP-0333
[4]	Communications (COM) System Reliability, Availability and Maintainability Report	REJ-05-0-0000-REP-0334
[5]	Overhead Catenary System Reliability, Availability and Maintainability Report	REJ-05-0-0000-REP-0335
[6]	Traction Power System Reliability, Availability and Maintainability Report	REJ-05-0-0000-REP-0336
[7]	Tunnel Ventilation System Reliability, Availability and Maintainability Report	REJ-05-0-0000-REP-0337
[8]	Station System Reliability, Availability and Maintainability Report	REJ-05-0-0000-REP-0338
[9]	Trackworks Reliability, Availability and Maintainability Report	REJ-05-0-0000-REP-0339
[10]	CBTC RAM Analysis (Signalling)	3CU 05018 0109 BCZZA
[11]	Communications Failure Modes and Effects Analysis	REJ-05-0-0000-REP-0340
[12]	Overhead Catenary System Failure Modes and Effects Analysis	REJ-05-0-0000-REP-0341
[13]	Traction Power Failure Modes and Effects Analysis	REJ-05-0-0000-REP-0342
[14]	Tunnel Failure Modes and Effects Analysis	REJ-05-0-0000-REP-0343
[15]	Station Failure Modes and Effects Analysis	REJ-05-0-0000-REP-0344
[16]	Trackworks Failure Modes and Effects Analysis	REJ-05-0-0000-REP-0345
[17]	Project Agreement	TORO1; 4868348: v55
[18]	Non-Electric Parts Reliability Database	NPRD-95

1.5.2 Referenced Codes and Standards

Ottawa Confederation Line Phase 1 has been designed in accordance with the requirements of the Codes and Standards identified in Table 3. Reference is made to the version in use at the time in which the PA was agreed.

Table 3: Applicable Codes and Standards

	Title	Document No.
[19]	The specification and demonstration of reliability, availability, maintainability and safety (RAMS)	EN50126
[20]	Maintainability Prediction	MIL-HDBK-472
[21]	Reliability Modelling and Prediction	MIL-STD-756
[22]	Electronic Reliability Design Handbook	MIL-HDBK-338
[23]	Reliability Prediction of Electronic Equipment	MIL-HDBK-217

2. PROGRAMME DESCRIPTION

2.1 PROJECT DESCRIPTION

The Confederation Line Project, as agreed between the City of Ottawa and Rideau Transit Group, involves converting a portion of the existing BRT system into an LRT system. The Project includes upgrades at some existing stations, construction of new stations, construction of portions of new track not within the existing BRT infrastructure, tunnelling through the downtown core and the construction of a new MSF.

Ottawa Confederation Line Phase 1 provides a Low Floor Light Rail Vehicle Light Rail Transit service between Tunney's Pasture and Blair stations. The 12.5-kilometre line includes a 2.5km mined tunnel beneath downtown Ottawa and an LRT MSF at Belfast Road, shown in Figure 2.

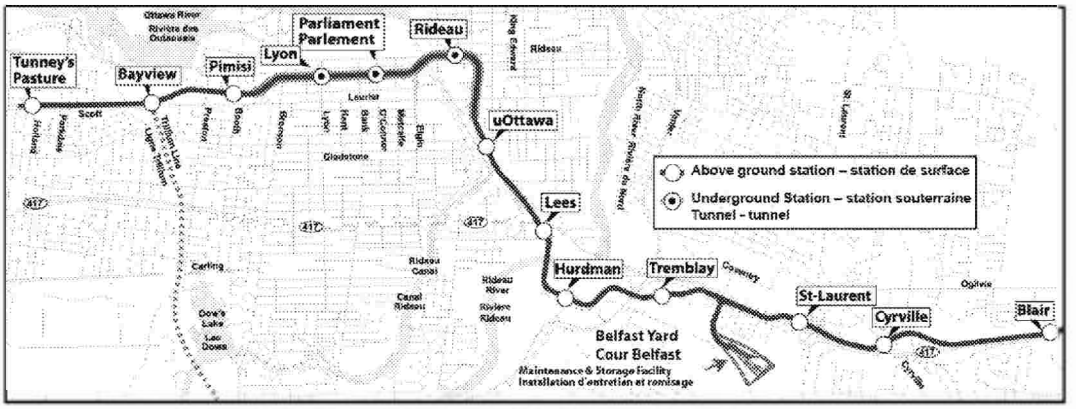

Figure 2: Ottawa Confederation Line - Phase 1

2.2 KEY PARTIES

Design of the majority of Ottawa Confederation Line Phase 1 infrastructure has been the responsibility of an Engineering Joint Venture (EJV) partnership between SNC Lavalin, Dragados and EllisDon.

Alstom Citadis Spirit low floor articulated rail vehicles are used to provide up to 300 passengers per LRV unit.

Communications Based Train Control (CBTC) moving block train control systems is provided by Thales.

Transit Services (OC-Transpo) provide all main line control staff, LRV Drivers, transit law and other customer service personnel.

Rideau Transit Maintenance (RTM) are responsible for maintenance of all systems and infrastructure including the LRV fleet.

2.3 ENVIRONMENT

There are 13 Ottawa Confederation Line Phase 1 Stations. Lyon, Parliament and Rideau Stations are Underground within a 2.5 km long downtown tunnel section, St-Laurent station is enclosed beneath a shopping complex, and the each of Tunney's Pasture,

Bayview, Pimisi, uOttawa, Lees, Hurdman, Tremblay, Cyrville, and Blair are at or above ground level.

Part of the railway is under the Ottawa Canal and below the rising water table and thus appropriate waterproofing and flood protection measures.

The environmental conditions present a range of challenges:

- Extremes of heat, cold and relative humidity
- Dust and particulate contamination
- Snow and ice on exposure
- High wind
- Saline conditions
- Shock and vibration
- Seismic activity
- Electromagnetic Interference.

2.4 DESIGN STRATEGY

The OLRT project has sought to minimise risk in terms of project schedule and cost, long-term safety and operational performance, by maximising the use of type approved and commercially available equipment that has been proven on operating railways within Canada or overseas. Systems have been selected for their pedigree of proven use and reputation for reliable performance and has been implemented through the equipment and supplier selection acceptance processes. IHA is therefore critical to ensuring that all systems are capable of operating in a safe and reliable manner.

The design processes have set out to deploy equipment in standard configurations maximizing the use of component redundancy with adequate fault detection to minimize the risk of hidden fault.

2.5 MAINTENANCE PHILOSOPHY

The Ottawa Confederation Line Phase 1 infrastructure has been designed to minimize the maintenance burden and logistic footprint. Maintenance has been rationalized to repair by LRU replacement at first line as far as is technically feasible, and preventive maintenance minimized by design and widespread implementation of SCADA monitoring capability.

This approach is considered to reduce safety risks to on-track personnel by minimizing the time within hazardous environments whilst maximizing benefit to passengers through on-time running and cost effectiveness. Assets have been selected for their inherent ease of maintenance whilst the infrastructure layout has been designed to permit necessary access, walking routes and provision for human factors.

2.6 OPERATING CONTEXT

Overall performance and cost effectiveness of OLRT is enhanced by embedding Supervisory Control And Data Acquisition (SCADA) as the fundamental feature of the operations concept. This approach automates equipment monitoring, many operating functions and enhances the overall operator decision-making.

3. RAM REQUIREMENTS

3.1 PA REQUIREMENTS

OLRT PA RAM requirements are shown in Table 4.

Compliance claims and verification and validations evidence against these requirements is presented throughout this document and detailed in Appendix C.

Table 4: RAM Related PA Requirements

DOORS ID	Requirement Description
91862	(i) Project Co shall develop and implement a system for the management of RAMS as part of the conceptual detailed design, Construction, installation, commissioning, testing, acceptance and operation phases of the contract. The RAMS program shall provide a statistical foundation for each asset's contribution to overall System performance.
91864	A. The RAMS program shall be undertaken consistent with the following minimum standards:
91865	i. RAM studies (IEEE 497)
91866	ii. ISO Standard (14224)
91867	iii. CAN/CSA-0632-90 – Reliability and Maintainability Management Guidelines
91868	iv. CAN/CSA-0396 – Software Quality Assurance Standards
91869	v. EN 50126 – Specification and Demonstration of Management of Reliability Availability, Maintainability and Safety
91873	A. The RAMS program undertaken by Project Co shall include the following:
91874	i. Analysis of RAMS component and System performance;
91875	ii. The use of Monte Carlo simulation as appropriate; and
91876	iii. Sensitivity tests to vary the performance of individual assets, interaction of assets, and the overall System.
91879	B. The RAMS reports shall be organized into the following major categories:
91880	i. Data collection;
91881	ii. Review and model validation;
91882	iii. Modelling and simulation;
91883	iv. Validation and documentation of simulation results and sensitivity testing; and
91884	v. Report generation/Systems assurance compliance.
91885	C. The initial RAMS report shall be submitted according to Schedule 10 – Review Procedure
94361	(b) Each subsystem Design shall be configured to maximize reliability and availability, have common interfaces, and meet common standards. Project Co shall ensure that Equipment chosen can be easily replaced or upgraded.
94575	(i) The Traction Power distribution system (OCS) shall be circuited into manageable electric sections. These sections are redundantly fed from two adjacent TPSSs to maintain reliability, continuity of service, fault discrimination and distribution of loading.
94900	(i) A single door operator shall control each pair of doors and ensure that the panels open and close simultaneously. The operator shall be a service proven Design with a history of reliability without the need for maintenance and adjustment. The door mechanism shall be suitable for operation in cold temperatures and snow and ice storms.

DOORS ID	Requirement Description
94911	(ii) A Door Enable feature shall release door control and illuminate a "Door Open" LED pushbutton at each active door, in the interior and exterior of the Vehicle allowing passengers to open individual doors by pressing the "Door Open" button. A pictogram shall indicate the function of the pushbutton switch. Pushbuttons out of service will not display energized LEDs.
95068	(ii) Redundant inverters and LVPS shall be provided with independent controls and control power supplies to provide maximum availability.
95674	B. All Equipment enclosures and frames of all resiliently mounted electrical apparatus, with the exception of the battery box, shall be suitably grounded to the car body.
95799	(a) Project Co's maintenance responsibilities related to the Non-Revenue Vehicles and the right of way are detailed in Schedule 15-3 – Maintenance and Rehabilitation Requirements. Project Co shall provide a sufficient number of Non-Revenue Vehicles to comply with these requirements, with consideration to availability, Mean Time to Repair, Response Time, etc.
95818	(i) Redundancy shall be built into all Train Control Systems to provide maximum availability.
95822	(i) EN 50126:1999, Railway Applications – The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS)
95828	(viii) IEC 61508, Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems
95844	(i) ATC Zone Controllers shall be distributed throughout the line to control the Train movements in the various zones. Redundant ATC Zone Controllers shall be provided in each zone. The number of zones shall be determined by the latency requirements of providing the required Headways, the requirements of maximum availability, as well as the requirements of the vital interface with the interlocking controllers provided.
96082	(i) The automatic mode of the ATS system shall control interlockings and switches, as well Train dwell times, Train speeds and acceleration rates within the parameters allowed by the ATP and vital interlocking systems.
96159	(a) Overall reliability of the CBTC Train Control System shall be such that with the provided redundancy, availability is 99.99% or greater. Availability calculations shall be based on the formula:
96162	(b) CBTC availability does not include failures of fixed block or broken rail detection systems or switch machines. etc.
96167	(i) Project Co shall provide calculations for the Mean Time Between Failures and Mean Time Between Functional Failures for all provided wayside networking Equipment, ATC Zone Controllers, VMIS, ATC and ATS Servers, local ATS processors, fixed block Train detection Equipment. Actual reliability data of similar installed systems may be provided as a substitute.
96168	(ii) Particular attention shall be paid to the reliability of the wireless communication system.
96268	(v) The CTS system shall be designed such that these component failures are minimized by redundancy. The availability of the system (i.e. availability of all system hardware, cabling) shall be greater than 99.9%, defined by more than 50% of circuits to any operational CTS.

DOORS ID	Requirement Description
96274	(v) The PA system shall be designed such that these component failures are minimized by redundancy. The availability of the system (i.e. availability of all system hardware, cabling) shall be greater than 99.9%.
96361	(xii) High availability application servers shall perform real-time data acquisition and processing, generation of supervisor control commands, database queries, overview display, alarm management, executing of diagnostic, administrative and maintenance programs. The computer system shall produce, at a minimum, alarm and related logs, summaries, and other user defined reports.

4. RAM ACTIVITIES

4.1 RAM RISK ASSESSMENT

This RAM Report has been compiled in order to provide a reasoned, auditable argument to support the contention that the OLRT infrastructure fulfils the requirements of the PA [17] requirements.

Assessment has followed a risk-based approach with verification evidence presented in a GSN format. The GSN is a stand-alone figure that has been compiled in order to illustrate the body of evidence presented in support of the RAM case and is not intended to align or integrate with any other GSNs that may be compiled for the OLRT programme. The GSN structure is shown in Annex A.

This approach sets out to present a compelling RAM case that utilises all available evidence whether predictive techniques, assessment of demonstrated performance or the identification of tangible measures implemented to ensure acceptable RAM performance.

The following information are referenced within the RAM report:

- RAM Prediction in accordance with industry standards
- RAM techniques in accordance with EN 50126 [19]
- Analogy to the demonstrated performance of similar systems and products
- Evidence of successful use from demonstration or qualification testing
- Identification of the design provisions implemented to mitigate RAM risks
- Implementation of engineering best practice and rigorous quality management.

4.2 RAM PREDICTION

The full system has been expressed as an Equipment Breakdown Structure (EBS). This includes all information required to describe the infrastructure. The EBS column headings are described in Table 5.

4.2.1 Reliability Prediction

Reliability prediction has been conducted as a parts-count analysis to determine the failure rate associated with each module or Line Replaceable Unit (LRU).

Reliability predictions have been captured from the RAM analysis for each system that was 4.2.1conducted by the OLRT EJV and expressed in an EBS. The EBS is shown in Annex C.

Failure Rates have been allocated based upon the following sources:

- Estimated based upon industry standards, such as RIAC-HDBK-217+ and MIL-HDBK-217F [23]
- Empirical data sets, including Institute of Electrical and Electronics Engineers (IEEE), Telcordia or Non-Electric Parts Reliability Database (NPRD) [18]
- Determined from manufacturer's qualification, demonstration, growth or field data
- Estimated based upon the judgement of robustness and dependability of the product and demands of the operating context

- Calculated based upon the reliability of lower-level constituent parts.

Data sources are identified as appropriate in order to provide traceability.

Combinations of data sources have been used in places in order to obtain the most representative failure rate. This may include the adjustment of empirical data based upon the known performance of legacy systems or fielded equipment.

Table 5: EBS Column Headings

Column	Description
IND	Hierarchical equipment unique identifier aligned to the EBS
SYSTEM	Top level system under assessment
DESCRIPTION	The name of the LRU / function / signal under assessment
QPU	Quantity of each item Per Unit
QPS	Quantity of each item Per System
MTBF	Mean Time Between Failure as the elapsed time interval between failures calculated as the inverse of failure rate
FR (p.m.o.h)	Number of failures per million operating hours (p.m.o.h) obtained from the predictive analysis
FR (p.m.o.h) x QPS	Number of failures per million operating hours multiplied by its population
Data Source	Source of failure rate allocated
Logistic delay	Amount of time between failure detection and maintenance personnel arriving on site
Access	Time taken to access asset
Isolation	Time taken to isolate/diagnose fault
Remove/Replace	Time taken to remove/repair/replace asset
Align/Adjust	Time taken to ensure correct setting
Test	Time taken to verify correct operation

4.2.2 Availability Prediction

Availability predictions are provided in the EBS for each equipment item and calculated for each system and is shown in Annex E.

This utilises reliability and maintainability prediction data described in section 4.2.1 and 4.2.3, respectively. This follows a hierarchical approach and consider operating factors such as modes of operation and redundancy.

Availability prediction has been conducted based upon Reliability Block Diagram modelling.

Performance assessment has been conducted based upon the FMEA modelling so Monte-Carlo simulation of equipment failures within a Reliability Block Diagram (RBD) structure for the whole infrastructure has not been conducted.

4.2.3 Maintainability Prediction

Maintainability predictions have been allocated to each module or LRU as Mean Time To Repair (MTTR) that consider the amount of time to complete the activities:

- Access–obtain means to entry and physical contact to permit working with the failed item
- Isolate – diagnose the fault down to the repairable item
- Remove and Replace – like for like replacement of the failed item
- Alignment and Adjust – reinstate items to necessary operating settings
- Test – confirm correct function of installed item.

Times are expressed in hours and do not include logistic delays associated with the administration or the travel of maintenance personnel. Logistic delays have been considered separately within the FMEA performance analysis.

Maintainability predictions have been allocated based upon demonstration, guidance of Original Equipment Manufacturers (OEM), empirical data such from MIL-HDBK-472 [20]or the knowledge of those experienced in working with the equipment under consideration.

4.3 FAILURE MODES, EFFECTS AND CRITICALITY ANALYSIS

4.3.1 Failure Management

The FMEA column headings are described Table 6.

Table 6: FMEA Column Headings

Column	Description
IND	Hierarchical equipment unique identifier aligned to the EBS
SYSTEM	Top level system under assessment
DESCRIPTION	The name of the LRU/function/signal under assessment
FUNCTION	Brief description of the function the asset installed to fulfil
FAILURE MODE	Ways and means in which the item might fail
CAUSE	The basic issue that leads to the failure mode becoming evident
LOCAL EFFECT	The effect of the failure mode upon the LRU/subsystem level
OPERATIONAL EFFECT	The effect of the failure mode upon infrastructure performance and for the purposes of this analysis, either:

Column	Description
[redacted]	

4.3.2 Testability Analysis

Testability analysis has been conducted to establish the distribution and completeness of detection methods for prevalent failures and establish the risks associated with hidden failures.

4.3.3 Performance Analysis

Overall system operating performance has been assessed based upon the content of the FMEA modelling to determine the capability and effectiveness of the overall infrastructure design. This has been used to calculate the amount of downtime and services delayed based upon the infrastructure reliability (MTBF), considering the infrastructure layout (availability) and associated downtime (MTTR).

This analysis can be used to inform the future maintenance strategy.

5. SYSTEMS DESCRIPTION

Sub-systems considered within the scope of the RAM analysis are discussed in the following sub-sections. Both inter-system and intra-system interfaces are considered within this report.

5.1 COMMUNICATIONS TRANSMISSION SYSTEM

Figure 3: MSF and TSCC LAN Architecture

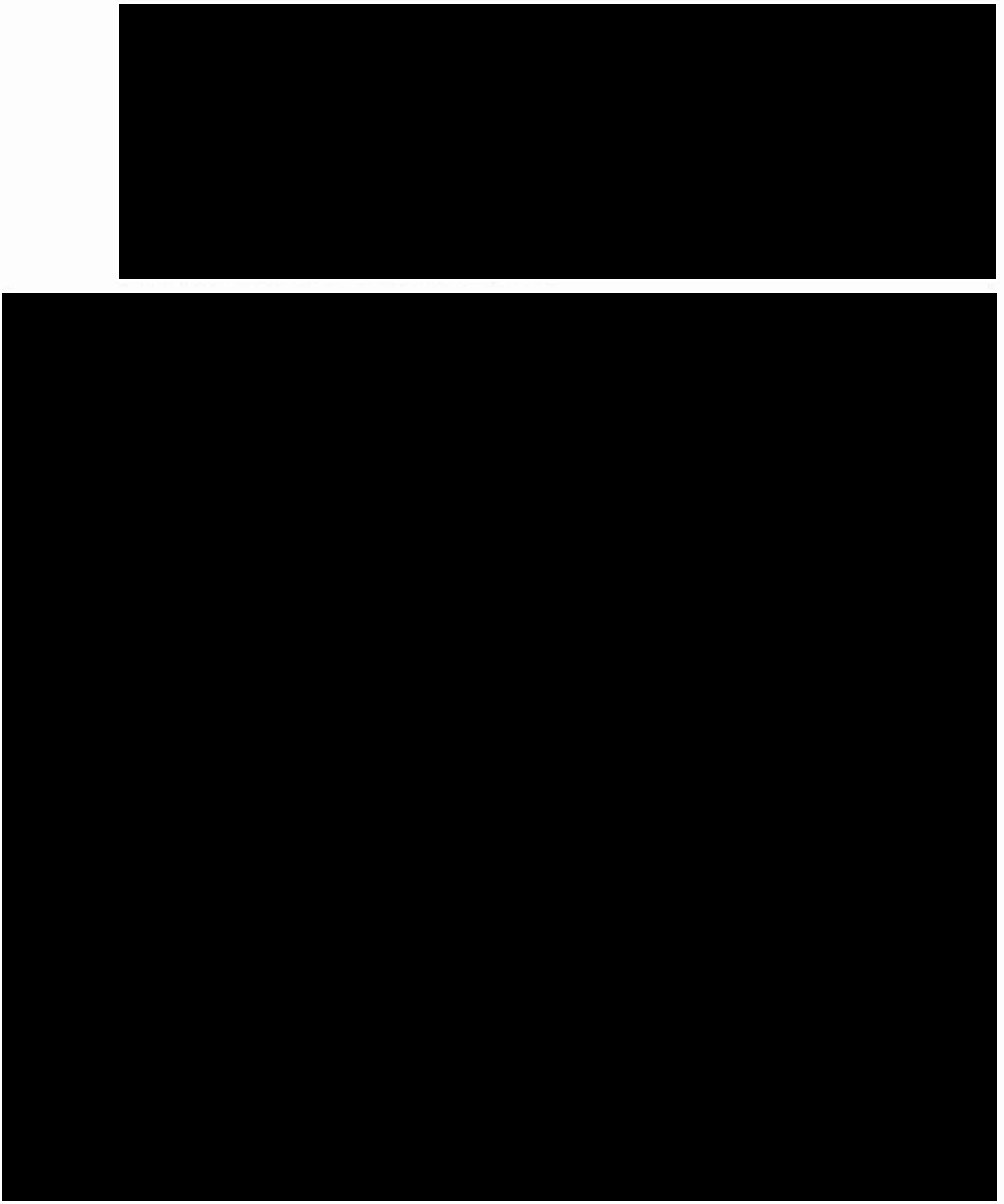

Figure 4: Station LAN Network

5.2 SCADA

5.2.1 Monitoring and Control

SCADA provides monitoring and control of field devices. A SCADA Remote Terminal Unit (RTU) is installed at each site, connects with local sub-systems and transmits control and indication information via the CTS network.

The overall SCADA architecture provides a remote control of HMI interfaces in order to access information of monitored devices, or systems in the stations, TPSS and MSF or along the guideway.

SCADA is a key system and fundamental to the OLRT operations concept. It controls, monitors and interfaces a wide range of field devices including Tunnel Ventilation System (TVS), Communications Based Train Control (CBTC), TPSS, FDAS, Intruder Access Control

Figure 5: SCADA System Architecture

5.2.2 Traction Power SCADA

Each TPSS is equipped with one Traction Power SCADA Remote Terminal Unit (RTU) located in the Electronic Equipment Room (EER) that communicates with the SCADA servers located in the MSF.

The interface occurs over the CTS network with a mix of copper and fibre cables. The Traction Power SCADA RTU is used to monitor the following data points:

- Digital input, e.g. door and gate contacts
- Digital outputs, e.g. elevator direction control
- Hardwire signals, e.g. fire alarm.

Traction Power SCADA RTU provides the monitoring and control of key elements at the substation, including:

- Control of AC and DC Circuit Breakers
- Monitoring of AC and DC Circuit Breakers
- Building and other services alarms.

The Traction Power SCADA at each TPSS consists of:

- RTU – to process and transmit the input outputs data
- I/O interfacing/termination - structured Cabling System
- Power distribution - to power the RTU rack
- Marshalling Panel - interface the RTU with the field equipment).

The Traction Power Programmable Logic Controller (PLC) communicates directly with the SCADA servers over the CTS network to provide monitoring and control including:

- Monitoring of AC and DC Circuit Breakers
- Voltage and current parameters
- Energy monitoring
- Negative grounding device.

The SCADA RTU interfaces are illustrated by Figure 6.

Figure 6: Traction Power SCADA RTU Interface Diagram

5.2.3 TVS SCADA Control

The TVS PLC controller communicates with the Master SCADA via the CTS network. The various ventilation operating scenarios are programmed in the PLC with configuration in the Master SCADA HMI to send specific mode numbers to the PLCs. The Master SCADA HMI and/or video wall are able to show operating status of the TVS graphical and using graph indicators.

5.3 TUNNEL VENTILATION SYSTEM (TVS)

TVS provides tunnel and passenger area ventilation and airflow for the 2.5km of tunnel area in the Downtown core area that includes Lyon, Parliament and Rideau Stations, as well as the enclosed sections of St. Laurent Station and adjacent tunnels.

Primary functions of the TVS are as follows:

- Provision of passenger comfort in normal and congested operating modes
- Emergency mode control in the event of fire in a tunnel, station or onboard train.

The TVS is controlled remotely, typically from the TSCC using SCADA to interface with the TVS control system and can be controlled via the TVS Control panel in the TVS control room during maintenance and test. TVS equipment is monitored via the TVS Programmable Logic Controllers (PLC) with faults reported to SCADA.

Redundancy has been incorporated through the population and configuration of fans and dampers at each location to ensure adequate transfer of air in the event of equipment failure during a fire or emergency condition.

Figure 7: Typical Segment 2 TVS Configuration

5.3.1 Jet Fans

Jet fans are located at the entries of the tunnel of segment 2 and on the East entry of the Saint Laurent Station to provide airflow control inside the tunnel and St Laurent Station. They are controlled by a dedicated Auxiliary Control Panel in Lyon, Rideau and St Laurent.

Jet fans are equipped with silencers on either side of the fan housing to attenuate noise and incorporate bird screens to protect against bird strike.

5.3.2 Axial Fans

There are four axial fans installed at the entrance to each underground station in segment 2 within dedicated fan rooms. Airflow is controlled via dampers and are linked to the surface by vent shafts.

Each fan is connected to two silencers on either side via transitional ducts and flexible connections.

5.3.3 Dampers

Dampers and related devices subject to exposure to the smoke laden air stream and are critical to the effective operation during a fire emergency, and are constructed of non-combustible, fire-resistant materials and designed to operate in an ambient atmosphere of 250°C (482°F) for a minimum of 1-hour meeting NFPA 130 requirements.

All dampers are interlocked to the fan controls to prevent the fans from operating against closed dampers and are equipped with a spring return to closed position in case of a power failure.

There are two types of dampers utilised by OLRT:

- Fan isolation dampers - installed at the immediate inlet or outlet side of each fan to enable fan isolation in the event of a fan failure during an emergency fire mode
- Draft relief dampers - installed facing the tracks to relieve the piston effect and are designed to fail closed.

5.3.4 Programmable Logic Controller

Programmable Logic Controllers (PLC) provide overall control of the TVS system. They are fully redundant SIL2 systems comprising two racks installed in the TVS room. The racks comprise a master and slave PLC that are synchronised and actively redundant in which control is passed to the Slave PLC in the event that a fault is detected with the master.

PLCs from each of the three stations communicate to synchronise the activation of the required fans in order to activate the requested ventilation mode.

5.3.5 Motor Control Centre

The Motor Control Centre (MCC) controls the electrical energy going inside the motor rotating its associated fan. This function is realised by the Variable Frequency Drive (VFD). Variable Frequency Drives are employed for all station fans in the system to improve motor starting inrush loading and efficiency in operation.

The MCC incorporates a motor protection relay to monitor the motor operating current, voltage, vibration and temperature which either trips or alarms depending of the fault detected.

5.3.6 Tunnel Vent Shaft

Vent shafts provide an air and smoke exhaust path from the station to atmosphere. Each of the three downtown underground stations have four ventilation shafts located at the ends of each Station platform.

5.4 INTRUDER ACCESS CONTROL

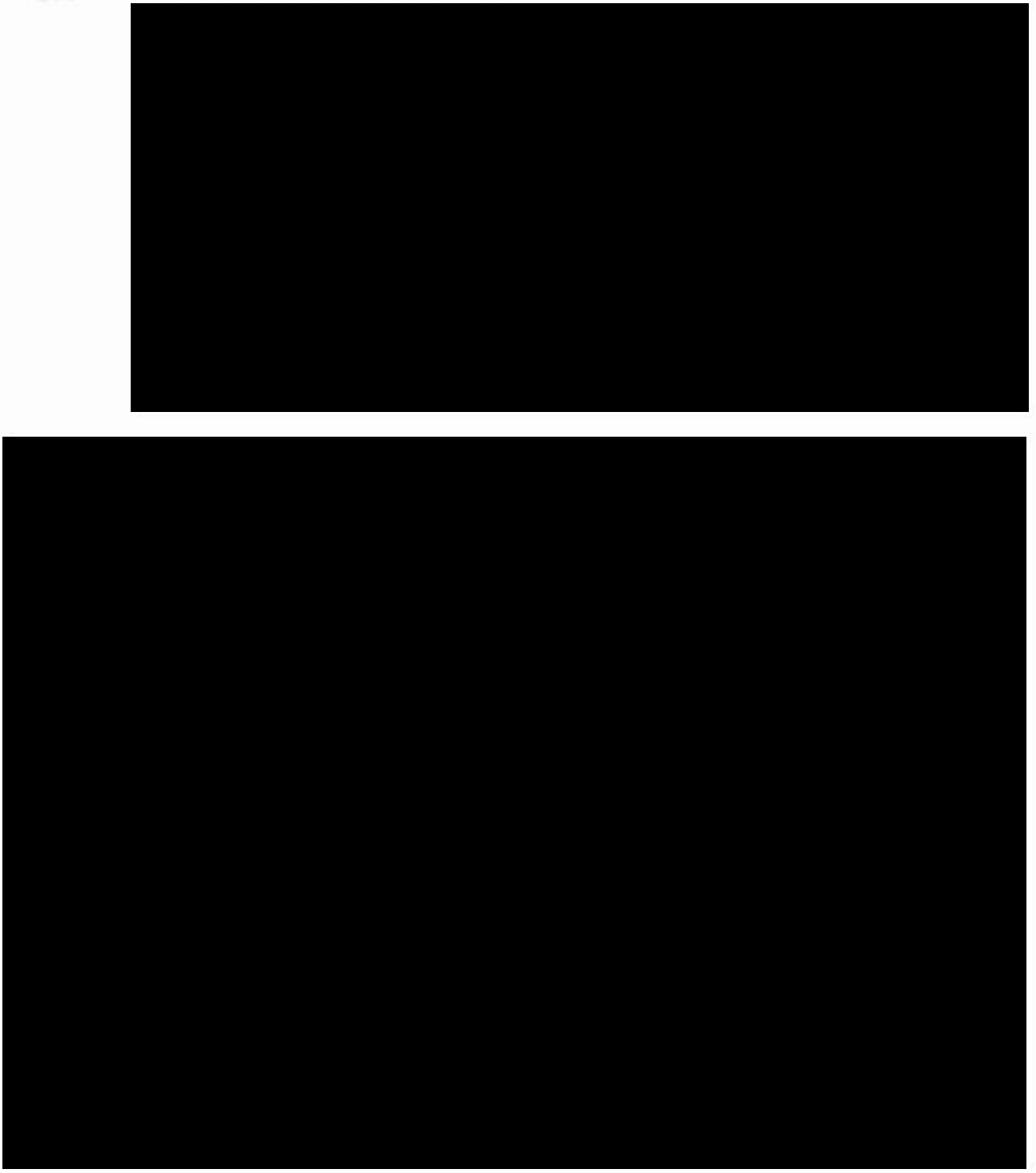

Figure 8: IAC System Architecture

5.5 GUIDEWAY INTRUDER DETECTION SYSTEM

The GIDS system is designed to detect and identify persons or objects that infringe into the scanner field of view and scanners are typically placed at points of intrusion to the guideway from a station platform or at a portal.

The scanner is a laser-based technology, whose signals can distinguish between trains passing and actual intrusions of the guideway (persons, objects).

The main components of GIDS is as follows:

Figure 9: GIDS Equipment Layout

5.6 PASSENGER INFORMATION SYSTEM (PIS)

The Passenger Information System (PIS) provides voice and visual communications to passengers that are typically travel or emergency information. The PIS comprises the Public Address (PA) system for audio communications and a Passenger Information Display System (PIDS) for visual information.

The PIS system provides the following primary functions:

- Broadcast station public address scheduled and ad-hoc messages
- Emergency announcement facility for first responders
- Display train arrival and departure times.

5.7 TELEPHONY SYSTEM (TS)

- The Telephony System (TS) provides emergency and non–emergency communication between the travelling public, operational and maintenance staff via VoIP devices.
- The TS comprises a range of phones including: Emergency Telephones (ETEL), Passenger Information Intercoms (ITEL), Elevator Intercoms (EHFI), Hands-free Intercoms (HINT), Staff Telephones (STEL) and Maintenance Telephones (MTEL).

5.8 CLOSED-CIRCUIT TELEVISION (CCTV)

The CCTV system provides visual awareness to inform TSCC operatives in the smooth running and effective emergency response to OLRT.

The CCTV system comprises CCTV cameras, fibre cabling and a network management system to permit footage to be viewed, recorded and played back at a range of workstations and video walls.

The CCTV system provides the following functions:

- CCTV imagery for monitoring of congestion and incident response
- Recording and playback for incident investigation, identification and apprehension
- Event triggered images in response to alarm (e.g. IAC, GIDS, OFFHOOK, etc.)
- Train movement monitoring for yard operations at the MSF
- In-cab train CCTV image feed
- Platform to Train Interface monitoring.

5.9 BUILDING AUTOMATION SYSTEM (BAS)

The Building Automation System (BAS) provides monitoring and control of electrical and mechanical systems that create comfortable ambient conditions for passengers and staff within buildings.

It operates in a similar way to SCADA and incorporates a degree of automation for the control of equipment including Air Handling Units, Condensers, Humidifiers, Space Heaters, Supply Exhaust Fan and Dampers.

BAS interfaces the TSCC for high-level control and fault monitoring. It is connected to the CTS via a Station Gateway and controlled by the SCADA server located in the MSF. The system is capable of functioning independently if connection to the SCADA server is lost.

5.10 HEATING VENTILATION AND AIR CONDITIONING

Heating, Ventilation and Air Conditioning (HVAC) is provided by Air Handling Units (AHU) ducted to Variable Air Volume (VAV) system elements to serve the equipment rooms within Stations.

AHUs consist of two supply fans in parallel and two return fans in parallel with each incorporating redundant refrigerant cooling coils in series, MERV 12 filters and economizer

plenums. Plenum supply and return fans are individually controlled by a variable frequency drive.

In the event of a fan failure, remaining fans are designed to ramp up to provide additional airflow to rooms with equipment necessary to run as required by NFPA 130 requirements. Equipment has been classified according to functional criticality to prioritise the supply of cooling air critical components in the event of degraded operation.

Each fan is partitioned to ensure full serviceability of the defective fan whilst the AHU remains in operation. Cooling coils are connected to dedicated indoor condensing units to ensure a complete separation of refrigerant circuits and eliminate single point failure.

Communications rooms housing critical train controls and fare equipment have dedicated exhaust fans to purge fire suppression clean agent discharge.

5.11 PLUMBING AND DRAINAGE

Plumbing and drainage systems comprise provision or control of sanitary and venting water, storm water, and domestic water.

Station sumps are pumped up to below the street grade level to tie into civil sanitary connections via force mains. Sump pumps are duplex electric motor-driven centrifugal pumps, sized to accommodate the worst-case scenario water flow, that discharge to civil storm water connections.

Storm water sump pumps are duplex electric motor-driven centrifugal submersible pumps, sized to accommodate the worst-case scenario sub-soil drainage water flow and the design rainfall across the surface area of the HVAC and Tunnel Ventilation shafts.

5.12 FIRE DETECTION AND ALARM SYSTEM (FDAS)

The Fire Detection and Alarm System (FDAS) monitors fire detection devices within all buildings and provides activation and automated responses in the event of emergency. A Fire Alarm and Control Panel (FACP) passes event data to the FACP in the TSCC and performs the following functions:

- Supervision and monitoring of all detectors, signalling and notification circuits for normal, trouble and alarm conditions
- Operation of all notification systems
- Release of fare gates and selected doors in response to trouble and alarm conditions
- Visual and audible annunciation of any trouble, supervisory or alarm condition
- Communication with other firefighters using Firefighter's Telephones (FTEL)
- Transmittal of GIDS intrusion alarms
- Transmittal of fire alarms to and from the train via CBTC.

The fire alarm system is a two-stage system for Stations and MSF, and single stage for the TPSS. The activation of any alarm initiating device triggers a first stage fire alarm to be initiated. The second stage fire alarm is initiated if the delinquency timer times out after 5 minutes or, if the switch in the ICP is activated or the evacuation alarm is operator initiated in the TSCC/BCC.

The fire protection systems are dry-pipe systems including sprinklers and standpipes. The incoming fire mains are complete with a double-detector check valve assembly and water meter, both located in the mechanical HVAC room mezzanine levels.

The incoming fire mains are served by the city water supply and supplemented by four sprinkler and standpipe Fire Department Connections (FDC) at each station. They are separately metered from the water main for the domestic cold-water system.

Station standpipe systems are automatic Class III dry-pipe type. They are served by a 100 mm diameter FDC located At Grade level within 45 meters of external fire hydrants.

Fire hose cabinets are Class III type with both 38mm and 65mm hose connections. Hoses are not provided for any fire hose cabinets. Minimum piping diameter of the standpipe system is 100mm.

Station standpipe system booster pumps are provided in accordance with Ontario Building Code (OBC) and NFPA 20 requirements, to ensure the minimum pressure can be achieved at the farthest fire hose cabinet at the station head houses Above Grade.

Booster pumps are connected to the station standpipe system on the upstream side of the dry valve. The water pressure available from the municipal supply is sufficient to meet sprinkler requirements.

The east and west tunnels connecting to Stations are each provided with separate standpipe systems, not part of the Station standpipe system. The tunnel standpipe systems are manual dry type.

Fire Dampers are provided to prevent the spread of smoke during a fire.

Each system is served by a 150mm diameter FDC located At Grade level. All standpipe systems are designed and installed as per OBC, OFC, NFPA 14 and NFPA 130.

Dry chemical multipurpose fire extinguishers are provided as per the requirements of the above codes and standards. Rooms containing a significant amount of sensitive electrical, electronic, communications or signalling equipment are provided with CO_2 fire extinguishers.

Refuse rooms contain a Class A fire rated water pump tank extinguisher. All portable fire extinguishers located in public spaces are enclosed in clearly identified recessed stainless-steel cabinets with solid covers or in fire hose cabinets

Automatic clean agent fire suppression systems are provided for the communication equipment rooms.

The clean agent system is monitored by the station fire alarm system.

5.13 STATION LIGHTING SYSTEM

The lighting system consists of all the equipment necessary to provide light in the station (Platform, non-public spaces, outdoors and emergency lighting).

Exterior lighting has been designed to enhance public safety and security and create an attractive and enjoyable exterior public space. Interior lighting in public areas is an important component of wayfinding strategy improving intuitive orientation and passenger flow.

5.14 STATION POWER SYSTEM

The Station Power System has been designed to deliver reliable operation, low energy consumption and ease of access for maintenance, convenient operation and at the same time be complementary to the architectural and structural designs.

- Power System - Nominal utilisation voltage levels and limits for the distribution of power shall be 120Vac for single phase circuits, and 208Vac or 600Vac for three phase circuits
- UPS – a UPS is installed to provide regulated and conditioned 60 Hz AC power to designated loads from 60Hz AC and from DC battery sources. The UPS comprises a solid-state rectifier/charger and inverter, status bypass switch, separate maintenance bypass, storage battery, synchronising equipment, protective devices and accessories that automatically achieve continuity of electrical power within specified tolerances upon the detection of failure or in the event of deterioration of the normal power supply. Continuity of electric power to load shall be maintained for an emergency period with the inverters supplied by the batteries, up to the specified maximum time of 240 minutes or upon restoration of power. The UPS feeds the following critical equipment/rooms:
    - Emergency lighting (90 minutes)
    - Fire pump (2 Hours)
    - Fire alarm (2 Hours)
    - Clean agent fire suppression system (2 Hours)
    - Public Address system (2 Hours)
    - Emergency telephones (2 Hours)
    - TVS Control equipment (2 Hours)
    - Comms Room (2 Hours)
    - Signalling Room (2 Hours)
    - SCADA (24 hours for supervisory circuits).

A static bypass switch is provided to maintain power through to critical equipment in the event of a UPS failure.

The three Under Ground Stations are not supported by a backup diesel generator but incorporated passive provision for future installation of connections to permit the installation of backup generator.

A manual bypass switch provides a means of switching power to the UPS under local control for maintenance and manual switching. The UPS is controlled and monitored via SCADA.

5.15 TRACTION POWER SUB-STATIONS (TPSS)

Traction Power Sub-stations provide power from the Hydro Ottawa power network to the OCS, which in turn, passes 1500 Vdc to power the trains and infrastructure.

Monitoring and control functionality for AC and DC supplies are provided by the SCADA system with connectivity through the CTS.

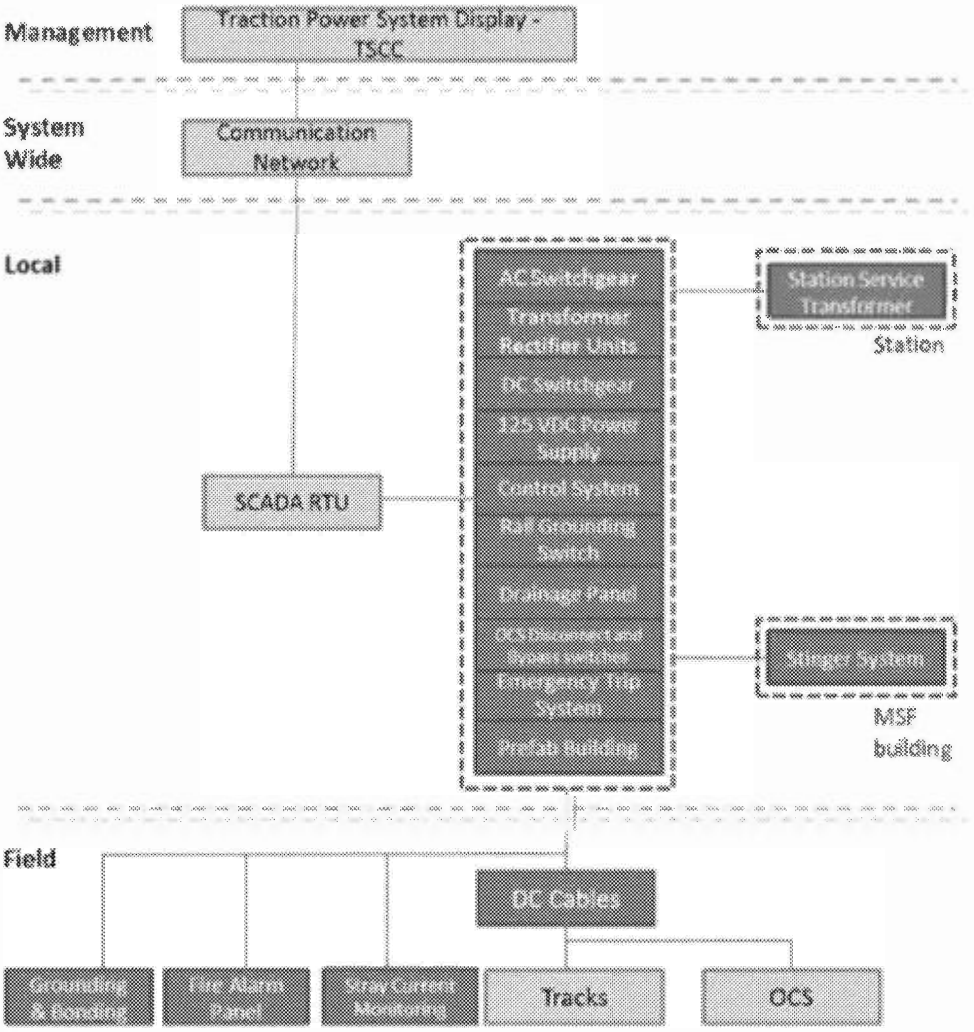

Figure 10: TPS Elements

5.15.1 AC Switchgear

The AC Switchgear is used to interrupt the incoming power flow and provide protection to the electrical system from overload and short circuit. It comprises circuit breakers, disconnect switches, load isolation switches, interlock relays and control devices.

AC Switchgear is draw-out type, metal clad switchgear which prevents the accidental contact of live parts by maintenance personnel. It is interlocked to prevent unsafe operation and incorporates protective devices to protect against faults, including phase imbalance, overcurrent and under voltage.

Voltage, current metering, health monitoring and diagnostics, alarm capability are incorporated in the design.

5.15.2 Traction Power Rectifier Transformer

Traction Power Sub-stations provide power from the Hydro Ottawa power network to the OCS, which in turn, passes 1500 VDC to power the trains and infrastructure.

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Voltage, current metering, health monitoring and diagnostics, alarm capability are incorporated in the design.

5.15.4 Traction Power Rectifier

Each TPSS incorporates a silicon diode traction power rectifier unit that meets the requirements of IEEE 1653.2. It is designed for extra heavy-duty operation with minimal risk in the degradation of performance.

The rectifier has a negative disconnect switch with two-stage temperature monitoring, two-stage diode monitoring and two-stage enclosure monitoring. The major elements of the TPSS DC switchgear are the main cathode circuit breaker, high speed DC feeder circuit breakers, and PLC based controller.

5.15.5 DC Switchgear

The DC Switchgear switches and interrupts outgoing power flow to protect the electrical system from overload and short circuit.

It is a metal enclosed single-pole, draw-out type feeder breakers equipped with load measuring auto-reclosing systems that is rated to interrupt maximum available fault current.

The major elements of the TPSS DC switchgear are the main cathode circuit breaker, high speed DC feeder circuit breakers, and PLC based controller.

5.15.6 Disconnect Bypass Switch

Each mainline TPSS incorporates 4 OCS Disconnect switches and 2 OCS Bypass switches, with the exception of TPSS01 (2 Disconnect switches, 1bypass), TPSS06 (6 Disconnect switches and 3 bypass) and TPSS08 (2 Disconnect switches, 1 bypass).

All the line disconnect switches shall be normally closed, and the by-pass switches normally opened. The by-pass switches are closed manually when the TPSS is out of service in order to support operations contingency.

Disconnect and Bypass switches isolate OCS sections from the DC Switchgear feeder circuit breaker and energise an OCS section from an adjacent TPSS when the OCS section is de-energised.

5.15.7 Negative Grounding Device

Each Rectifier Transformer Unit incorporates Negative Grounding Device (NGD) that monitor the potential between the negative bus and the sub-station ground grid and open in the event that a predefined level is exceeded. The NGD closes in the event that a pre-set potential is exceeded. NEGs are monitored via SCADA

5.15.8 Auxiliary Power Supply

Standalone TPSS buildings receive backup powered form Auxiliary Transformers via a 600/347V 3-phase, 4-wire Distribution Panel Boards.

Any TPSS that is adjacent to a station building receive Auxiliary Power from the station electrical room.

5.15.9 125vdc Power 5upply

The 125VDC power supply system is provided for each TPSS and used for TPSS controls, relaying, SCADA and other functions.

The system consists of a step-down transformer, a battery bank, a battery charger, DC distribution panels and all necessary equipment to provide a 125VDC power supply system.

5.16 OVERHEAD CATENARY 5YSTEM (OC5)

The OCS provides the interface to provide DC power to trains. It comprises an overhead contact line, cantilevers, poles, foundations and return circuit. The Overhead Contact Line (OCL) consists of contact wire, messenger wire, hanger or droppers, fixed points and tensioning devices.

The OCS is divided into a number of tension lengths with terminations or tensioning equipment located at each end. Tensioning equipment pulls the contact wire and messenger wire to maintain tension to ensure correct interface to the train pantograph across the climatic envelope.

The contact line is secured by midpoint anchor near to the centre of the tension length to provide longitudinal stability. Overlap sections ensure smooth transition between two adjoining sections.

5.16.1 Above Ground and Elevated 5ections

Simple Catenary Auto-Tensioned (SCAT) System is used at above ground and elevated sections of the mainline. This system consists of a 350kcmil hard drawn copper contact wire and 500kcmil, 37 strand hard-drawn copper messenger wires. Typical stagger is 300mm maximum. The OCS is designed for the temperature variation and ice loading of the Ottawa environment

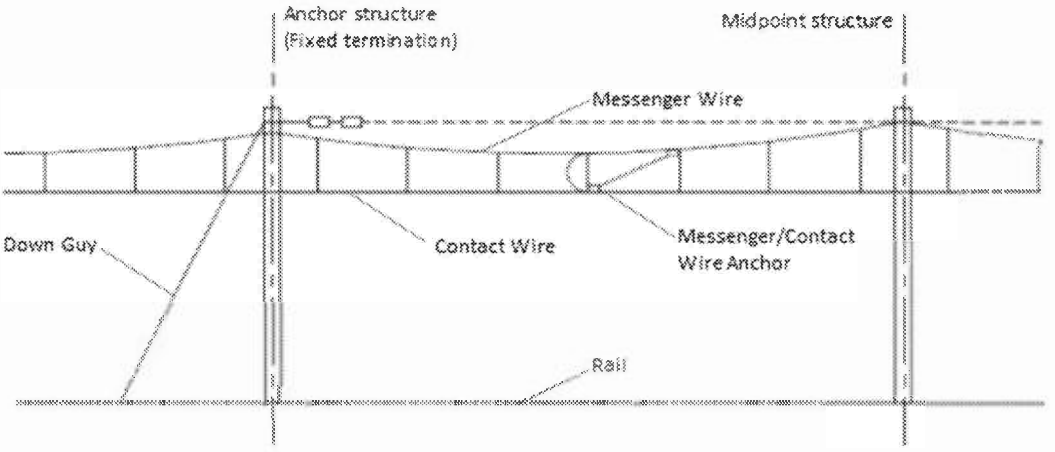

Figure 11: Typical Midpoint Arrangement

The contact wire height from top of rail varies to provide clearance from the structures. The nominal catenary system depth of 1220mm. The poles are tapered and generally be between the tracks with spacing no more than 60m. Tension lengths are no more than 160m to accommodate the large variation in ambient temperature in the Ottawa environment. Tensioning is provided by Balance Weight Assemblies (BWA). Short tensioning sections, for example in the special trackwork, is provided by spring tensioners.

Insulated overlaps are provided at OCS for sectioning the OCS except for shop tracks, where double section insulators are provided. Insulated overlaps or section insulators are also provided at crossovers to further sectionalise the OCS. These overlaps or section insulators are located to allow for train movement and turnback without loss of traction power.

Pole-mounted manual disconnect switches are provided at these overlaps or section insulators to allow normal power flow in the OCS section, as is shown in Figure 12.

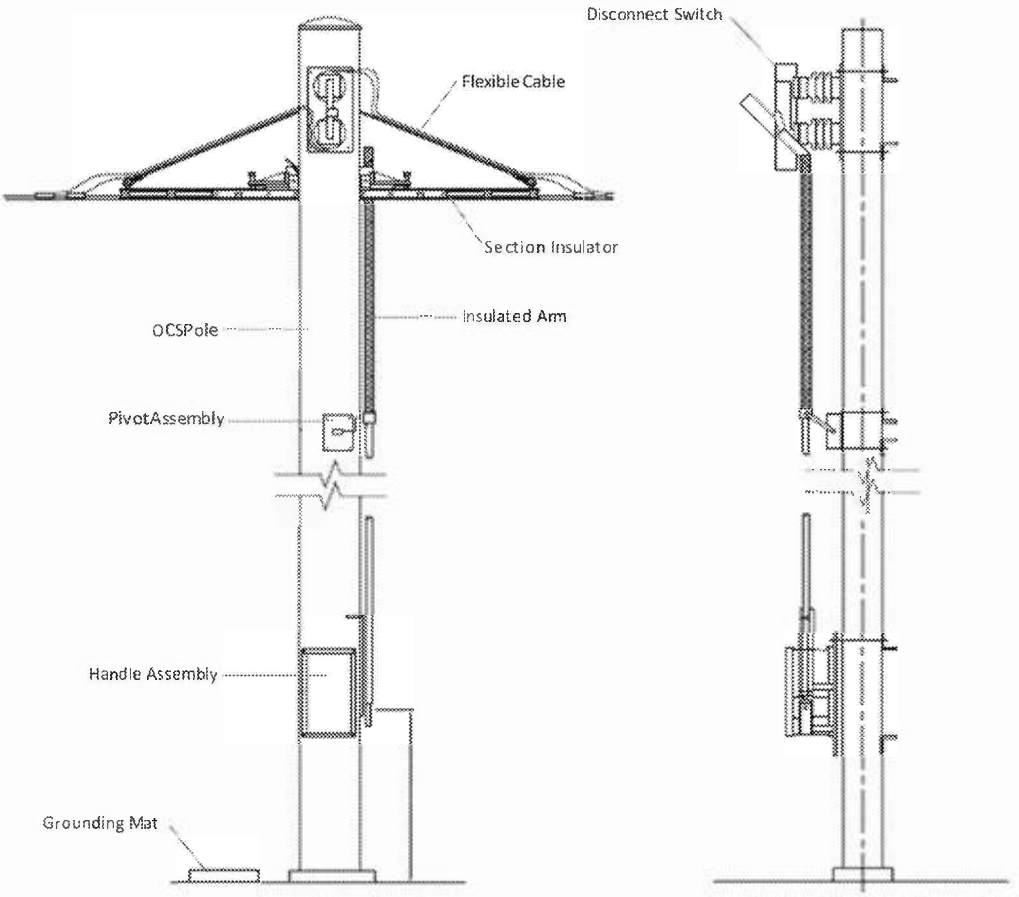

Figure 12: Pole Mounted Manual Disconnect Switch

A connection between each OCS lightning arrestor and ground is provided at each feeder point. The lightning arrestors have a minimum energy discharge capability of 2.6kJ/kV.

The overhead catenary system is electrically sectionalised by means of insulated overlaps near each substation. The OCS design adopts a combination of both insulated wire overlaps and section insulators. The OCS requires sectionalisation at crossovers, Yard Lead, and other special trackwork. Section insulators are used at crossovers, pocket tracks, turnout, and siding locations.

5.16.2 Tunnels and Underground Sections

Aluminium rigid conductor rail is used within tunnels and underground sections. It is fixed to the roof of the tunnel using steel frame supports and installed with a stagger. Overlapping gaps and anchors are provided to accommodate the expansion associated with the varying temperature of the conductor rail when in operation.

The support steel frame is insulated from ground. Insulators are provided between the steel support and the rigid rail hangers.

Transition structures between overhead catenary and rigid conductor rail is installed at tunnel entrances and exits. This uses a stress relaxation mechanism in order to minimise the transition length and ensure smooth current collection by the pantograph.

Insulated expansion joints with ceiling mounted disconnect switches are used for the diamond crossover within Underground Sections.

5.17 COMMUNICATIONS BASED TRAIN CONTROL (CBTC)

The OLRT Train Control system comprises the Communication Based Train Control System (CBTC) elTrac train control signalling system. CBTC is a moving-block system and uses track-to-train communications providing automatic, supervisory and operator functionality for the safe operation of trains.

The CBTC Train Control system comprises equipment to deliver Automatic Train Operation (ATO), Automatic Train Supervision (ATS) and Automatic Trian Protection (ATP), as well as other Normal, Degraded and Emergency operating modes.

CBTC shares information with the wider OLRT system via the SCADA system including train location and fire and emergency alarm status.

The primary functions of the CBTC system are:

- Train control
- Safe separation of controlled trains
- Train routing
- System supervision and monitoring
- Train schedule management (timetable, dwell time etc.)
- Emergency and Degraded (Trouble) mode functionality (e.g. station closure)
- Support and Maintenance tools

The CBTC system architecture is shown in Figure 13 and the elements are described in the following subsections.

Figure 13: TCTS CBTC System Architecture

5.17.1 Vehicle On-board Controller

The VOBC is a vital CBTC component. It consists of a Main Processor Unit (MPU) and a Peripheral Processor Unit (PPU) that can be installed in a standard 3U or 6U high, 19-inch rack.

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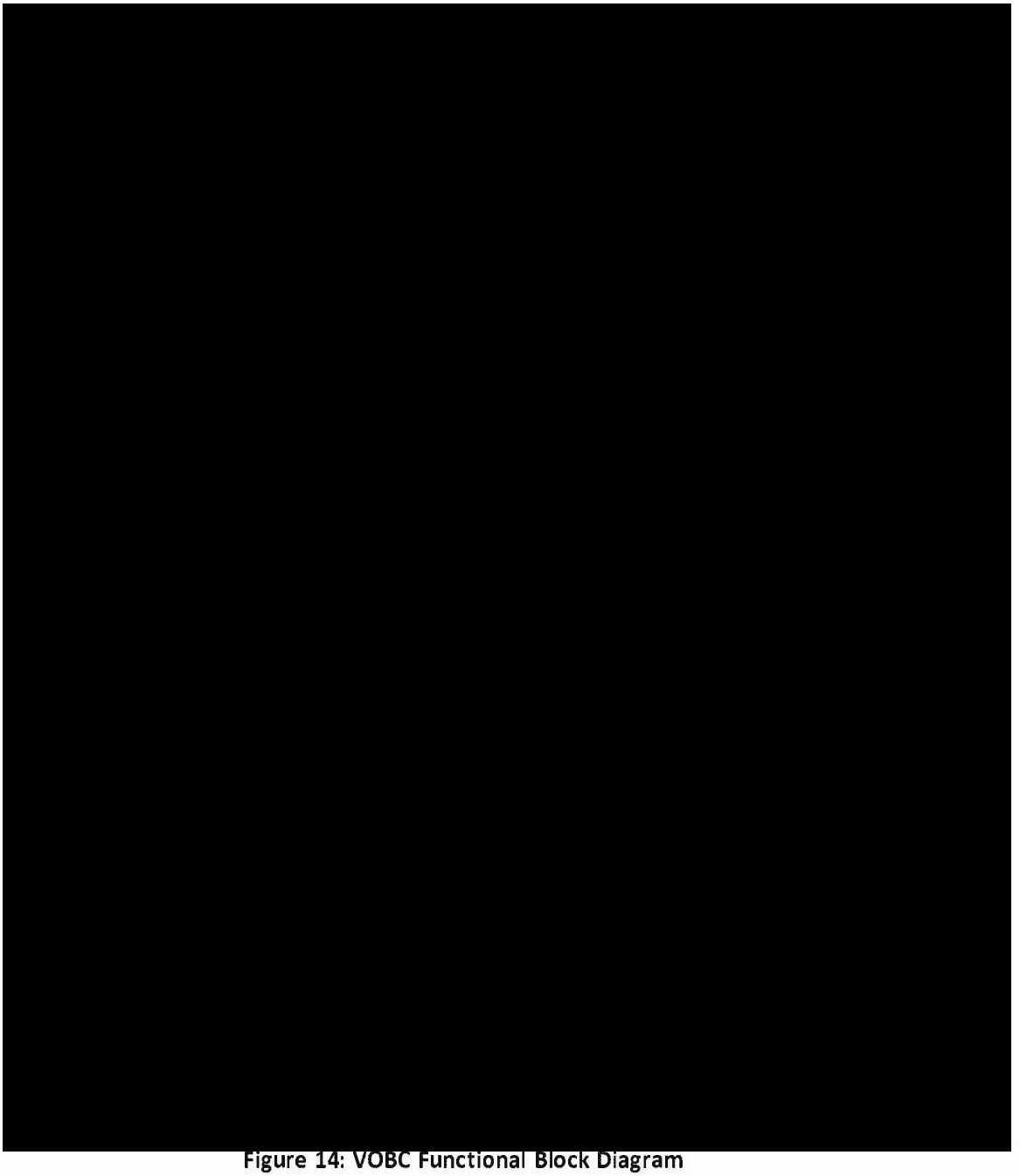


Figure 14: VOBC Functional Block Diagram

5.17.2 ZC Hardware

Figure 15: ZC Functional Block Diagram

5.17.3 Data Communications Systems

The Data Communications System (DCS) provides the means by which communications are made between CBTC components and external interfaces.

DCS is a non-vital subsystem as not directly involved in control of trains or interlockings and but is responsible for the transfer of vital data. Time critical poll-response communications, data checking, message sequence numbering, verification of source and destination and encryption functions are employed.

Software Defined Radio (SDR) is used on On-Board Radio Unit (OBRU), Wayside Radio Unit (WRU) and in the DCS racks.

5.17.4 Automatic Train Supervision

The Automatic Train Supervision (ATS) Central Server Architecture performs application processing on a single pair of redundant servers in a central location. These servers, called Schedule Regulation System (SRS), provide all of the ATS processing logic during normal operations. Local Schedule Regulation System Servers (LSRS) servers provide fall-back operations in the event of complete central server failure.

Figure 16: ATS Functional Block Diagram

5.18 TRACK

Track and associated foundations and support structures have been installed to provide strength, durability and a continuous and level path to direct train movement.

RAM assessment for the Track is given in EJV TRK system RAM Analysis (Track Work), REJ-05-0-0000-REP-0339.

Track system for OLRT can be described as follows:

- Running Rail
  - 115RE high strength tee rail (310 Brinell) as per the AREMA standard
  - All main-line running rail is Continuous Welded Rail (CWR) compliant to AREMA standards
  - All rails within the MSF are 115RE but are jointed rather than CWR
  - Restraining Rails have been provided on all sharp radius curves below 150m radius.
- Fasteners
  - Direct Fixation Fastener (DFF): by cast, rolled or forged, top and bottom metal plate bonded with rubber, anchored into the slab by anchor bolts with inserts. Rail is secured to DFF fastener by two elastic clips. Tie and ballast at the MSF: two elastic clips inserted into cast shoulders of a monoblock concrete tie
  - Two different strength of fasteners have been used. These are 18.5kN/mm for normal track conditions and 9.5kN/mm for the specialist requirements of noise and vibration control.
- Supports
  - Plinths: cast-in-place reinforced concrete plinths as per the ACI standards are sized to accommodate direct fixation fastener assemblies and reinforcing steel with a minimum cover of 38mm
  - Monoblock concrete ties with embedded shoulders, per AREMA standards, to be used in the MSF concrete deck on the elevated structure, concrete slab invert in the tunnel and concrete slab in the at-grade, normally reinforced with steel. Ballast, sub-ballast, and subgrade: all layers as per the AREMA standards in the MSF.
- Special Trackwork
  - Includes turnouts, crossovers, diamond crossings, switch clearing devices, end-of-track protection devices and rail expansion joints
  - Turnouts are based on AREMA geometry for all DF mainline tracks and yard lead tracks and use 115RE rail, with UIC 60E1A1 rail section for the switch blades. Of the 30 main-line turnouts, 12 are installed on concrete slab and the remaining 18 are on concrete ties. However, turnouts at the MSF are installed on timber ties

- All turnouts at the MSF, on the elevated guideway and in the at-grade guideway are equipped with switch clearing devices to keep all switches and frogs free of ice and snow under all conditions
- All turnouts are equipped with electrically-operated control switch machines, provided by Thales under the command and control Contract, and other associated equipment
- All main-line turnouts, except 305-308points between Lyon and Parliament stations, are fitted with electric switch heaters. These are linked back to the TSCC via the SCADA system. 305-308points have no heaters as they in a constant environment in the main tunnel
- All MSF turnouts have gas supplied switch heaters
- Rail expansion joints have been provided at each end of Rideau River Bridge to provide thermal expansion protection to the bridge structure.

- Drainage
  - Track drainage is a component of track work and must be sufficient to remove water from the guideway surface and subsurface
  - On the elevated guideway structure and in the tunnel, the track drainage is part of the structural design.
- Track bed
  - Direct Fix Track - Direct Fix Track is utilised in locations where for performance, noise and vibration control, existing soil conditions, structural clearances, or dead load restrictions, it is desirable to have the rail directly fixed to the concrete structure
  - Ballasted Track –mainline ballasted track utilises pre-stressed concrete ties that have been designed for electrical isolation and vibration attenuation upon a formation that has been designed to minimise maintenance overhead
  - The ballasted track structure is designed to provide a degree of resilience based on the magnitude of load distributed to the rail and track structure. Rail fasteners for ballasted track is spring clip type for the pre-stressed concrete ties
  - The fastening system for the concrete tie and comprises:
    - Elastomeric rail pads
    - Spring steel clips
    - Cast in shoulders and inserts
    - Insulators
- Gauging and Structural Clearance
  - The EJV Track work Contractor has taken accountability for demonstrating that safe structural and passing clearances have been achieved. This is based upon an agreed dynamic profile for the Citadis B15 tram, a maximum line-speed potential of 100Km/ph for the design alignment and geometry
  - Safe clearance to all line-side equipment

- Safe clearance of emergency walkways within the tunnel section.

- Maintenance
  - The EJV Contractor has provided a combined Track-Work Maintenance Manual covering the recommended general and specific inspections that are required.

6. ASSUMPTIONS

6.1 RAM PREDICTION ASSUMPTIONS

The following assumptions have been made in generating reliability predictions:

- Equipment is operated within Ground Fixed operating environment with the exception of on-board equipment that is Ground Mobile
- Equipment is operated within environmental conditions specified within the PA requirements
- Equipment is operated and maintained by adequately trained and skilled personnel
- Equipment is operated and maintained in accordance with designated procedures
- Reliability predictions are steady stated and do not consider wear out or early life failures
- Failures follow a constant failure rate hence the MTBF is the inverse of failure rate
- System configuration for At Grade stations is as per the Underground stations but with the removal of air conditioning, sump pumps and selected items from the fire protection and lighting systems.

6.2 FMEA ASSUMPTIONS

The following assumptions have been made in conducting the FMEA modelling:

- All elements in the system are operating correctly, other that the failure mode under consideration or unless otherwise stated
- Equipment is used in accordance with training operating procedures and technical publications
- Malicious actions are not considered in the analysis
- Failure mode ratios are based upon table 7.8-1 of MIL-HDBKL-338B and by engineering judgement where appropriate information does not exist
- Reliability data output from the FMEA modelling considers failure occurring within any operating phase
- Delay minutes have been derived based upon the sum of MTTR and logistic delay, against the mean average number of trains during operating hours that are identified in the OLRT Initial Train Service Plan, RTM-17-0-0000-MPL-0004
- Delays occurring to passenger behaviour, adverse weather or acts of god have not been considered
- Failure mode ratios have been sourced from MIL-HDBK-338 where appropriate is applied based upon the anticipated behaviour of the infrastructure or operations personnel
- Failures that do not impact services (loss of redundancy) can be scheduled according to the requirements of the operator and appetite for "time at risk"

- Corrective or preventive maintenance, or calibration, inspection and tests that do not impact services can be performed during normal daylight operating hours
- Failures relating in a loss of service associated with OCS or Track have been assumed to be mitigated by routing services onto the opposite track to "drive around" the failed asset. Downtime has been assumed to be 0.5 x MTTR and the number of services affected has been altered accordingly. It is assumed that switch crossings, bi-directional signalling and adequate TSCC operative processes are in place to facilitate this course of action
- Preventive maintenance is not service effecting as either conducted "out of hours" or during normal operation but does not impact operating services. Hence, whilst the preventive maintenance does not result in a loss of service but is considered a degraded or "time at risk" and results in a loss of service in the event of secondary failure of associated equipment
- Redundant items are considered to exhibit active redundancy and undergo immediate switch-over and continued operation.

6.3 RBD ASSUMPTIONS

The following assumptions have been made in conducting the RBD modelling:

- RBDs have been compiled based upon the guidance of MIL-STD-756
- Signalling RBDs have been sourced from the CBTC RAM Report, 3CU 05018 0109 BCZZA
- Availability has been calculated based upon the Mean Time Between Service Affecting Failure and Mean Time To Repair, as follows: MTBSAF / (MTBSAF + MTTR)
- Station Availability of 99.76% has been sourced from the EJD STA System RAM Analysis, REJ-05-0-0000-REP-0338
- TVS Jet Fans and associated Isolation Dampers exhibit 2oo3 active redundancy in with the modelling approach defined in EN 61508
- The availability of MSF systems and services (with the exception of CTS and Signalling) is assumed to be approximately that of stations
- TPSS have been modelled to exhibit active redundancy with power switched over to the adjacent TPSS in the event of critical failure
- Only operationally critical equipment is considered
- GIDS, TS, PA, PIDS and IAC are within the scope of CTS RBD. Reference should be made to the EBS in Annex D for hierarchy, scope and grouping of systems.

7. RELIABILITY PREDICTIONS

Reliability prediction worksheets are shown in Appendix C. System level parts-count reliability predictions are shown in Table 7: Reliability Prediction Summary.

Table 7: Reliability Prediction Summary

System	Measure	Failure Rate (p.m.o.h)	MTBF (hrs)
CCTV	per AG/UG station	268.38	3,726
CTS	per AG/UG station	139.45	7,171
GIDS	per AG/UG station	80.51	12,420
IAC	per AG/UG station	90.83	11,010
OCS	Line of Route	365.89	2,733
PA	per AG/UG station	393.81	2,539
PIDS	per AG/UG station	30.86	32,409
SCADA	per AG/UG station	38.93	25,690
SIGNALLING	Line of Route	2,971.71	337
UG STATION	per UG station	63,172.36	16
AG STATION	per AG station	54,984.68	18.19
TPS	per TPSS	800.98	1,248
TRACK	Line of Route	621.39	1,609
TS	per AG/UG station	87.42	11,440
TVS	per UG station	696.46	1,436

The calculated subsystem reliabilities are considered to be broadly acceptable with the exception of the those for stations. It considered that the asset populations and failure rate predictions shown in the EJV STA (Stations) RAM Report REJ-05-0-0000-REP-0338 are inaccurate and overly pessimistic.

The high asset populations (particularly for stations) suggest that there will be significant maintenance burden and need for personnel resources. This may not be the case in practice.

Asset populations sourced from each of the EJV RAM Report have been utilised in the absence of any further information or opportunity to conduct a comprehensive configuration audit or document review. Hence, the failure rate information that is shown in Table 7 and in Annex D, particularly for stations, should be used with caution

8. FMEA OUTPUTS

8.1 FAILURE EFFECTS

Failure effects have been captured from the FMEA shown in Appendix D.

Of the 1,532 failures assessed by FMEA, 146 cause a Loss of Service and 1,386 resulted in maintenance action to rectify but No Operational Effect.

The amount of delays incurred by system are shown in Table 8.

Table 8: Operational Delays Per Failure by System

System	Downtime= 0 Mins	Downtime 0-1 Mins	Downtime 1-10 Mins	Downtime 10-60 Mins	Downtime >60 Mins
CCTV	18			1	
CTS	121				4
GIDS	6				
IAC	10				
OCS	11			28	37
PA	9				
PIDS	14			1	
SCADA	22				1
SIGNALLING	699			8	
UG STATION	207				3
AG STATION	141				3
TPS	70			5	2
TRACK	4			5	9
TS	20				
TVS	34	7			15
Grand Total	**1386**	**7**		**53**	**86**

The extensive redundancy incorporated into the design means that most of the failure modes assessed resulted in no downtime or effect upon train services. Those resulting downtime in excess of 1 hour are improbable as they are associated with concurrent or common cause failures. It is considered appropriate to revisit this analysis based upon more accurate data than that obtained from the current EJV RAM analyses.

8.2 SERVICE PERTURBATION

The predicted amount of downtime and services delayed due to failures associated with each system is shown in Table 9.

This considers both the individual system and the total for that system across the entire OLRT line of route.

Table 9: Average Delays per Incident, Downtime and Services Delayed Per Year Per System

System	Services Delayed per incident (Average)	Downtime (Hr/Yr)	Services Delayed per Year (each)	Services Delayed per Year (All - Line of Route)
CCTV	4.33	0.000062	0.07	0.95
CTS	5.77	0.002321	0.52	6.82
GIDS	0.47	0.000150	0.03	0.48
IAC	0.00	0.000000	0.00	0.00
OCS	21.38	0.000305	2.88	2.88
PA	0.00	0.000000	0.00	0.00
PIDS	0.58	0.000062	0.07	0.07
SCADA	4.33	0.000015	0.03	0.03
STATION	1.54	0.018564	1.26	16.38
TPSS	4.77	0.068390	1.89	15.12
TRACK	22.26	0.068667	34.37	34.37
TS	0.00	0.000000	0.00	0.00
TVS	11.43	0.004750	2.19	8.76
CBTC	0.73	0.000130	0.05	0.05
		TOTAL	**43.37**	**85.91**

This analysis suggests less than 86 services could be delayed per year as a consequence of equipment failure. This would be considered to represent an excellent level of service delivery performance and remain an operating target.

The analysis may be artificially skewed by the high asset populations identified in the EJV RAM analyses and the extensive redundancy that has been inferred, particularly for stations. The analysis suggests that the only failures that would lead to station closure would be a false alarm associated with protection devices. It is considered that there would be many other functional failures that may lead to station closure in practice.

It should be noted that the analysis shown above does not consider delays due to adverse weather, security events, rolling stock or operational delays attributed to the actions of drivers, controllers or passengers.

8.3 DETECTION METHOD

The distribution of the detection method per system is shown in Table 10.

Table 10: Failure Detection Method Per System

System	SCADA Error Message	Signalling Error Message	Evident to Operator	Periodic Inspection	None
CCTV	19				
CTS	125				
GIDS	7				
IAC	10				
OCS				76	
PA	9				
PIDS	11		2	2	
SCADA	21		2		
SIGNALLING		707			
STATION	153		13	3	59
TPS	61		3	2	11
TRACK				18	
TS	19		1		
TVS	56				

9. AVAILABILITY ANALYSIS

Reliability Block Diagrams (RBD) for the OLRT infrastructure line of route have been compiled and are shown in Annex F.

The Availability for the OLRT infrastructure has been calculated to be **99.07%.** This considers all geographic locations and systems with the exception of rolling stock.

The breakdown of availability by core systems is shown in Table 11.

Table 11: RBD Availability by System

System	Availability
Stations	99.9700%
MSF CTS	99.9980%
Station CTS	99.9999%
Signalling zone controllers	99.9999%
Signalling DCS	99.9999%
Signalling VOBC	99.9999%
Signalling ATS	99.9999%
TPSS	99.9980%
TVS	99.9941%
OCS	99.9717%
Track	99.5454%

10. RECOMMENDATIONS

10.1 DRACAS

A failure review board should convene on an on-going basis to implement Data Recording Analysis and Corrective Action System processes (DRACAS) in order to identify and oversee lessons learnt and drive continuous improvement of service delivery performance.

This should involve stakeholders from each functional discipline (maintainers, controllers, service managers, etc.) and a level of support from the supply chain when required.

Given the OLRT infrastructure mostly comprises newly installed commercially available equipment that has been proven through demonstrated operational use. Hence, the principle benefits of DRACAS are realised by addressing construction and manufacturing faults and putting in place measures to improve maintenance effectiveness and fault response performance. Hence, the focus should be on the identification and rectification of manufacturing and construction anomalies and putting in place measures to maximise the effectiveness of maintenance and associated support organisation.

10.2 RELIABILITY CENTRED MAINTENANCE

A Reliability Centred Maintenance (RCM) assessment should be conducted with the input of a trained RCM facilitator and front-line maintenance personnel to derive a maintenance strategy that is aligned to the needs of each individual asset. This should be conducted once the OLRT infrastructure is operational so that it can consider lessons learnt from on-going performance reviews, DRACAS processes and the knowledge and experience of the maintenance personnel.

10.3 OPERATIONAL SUPPORT

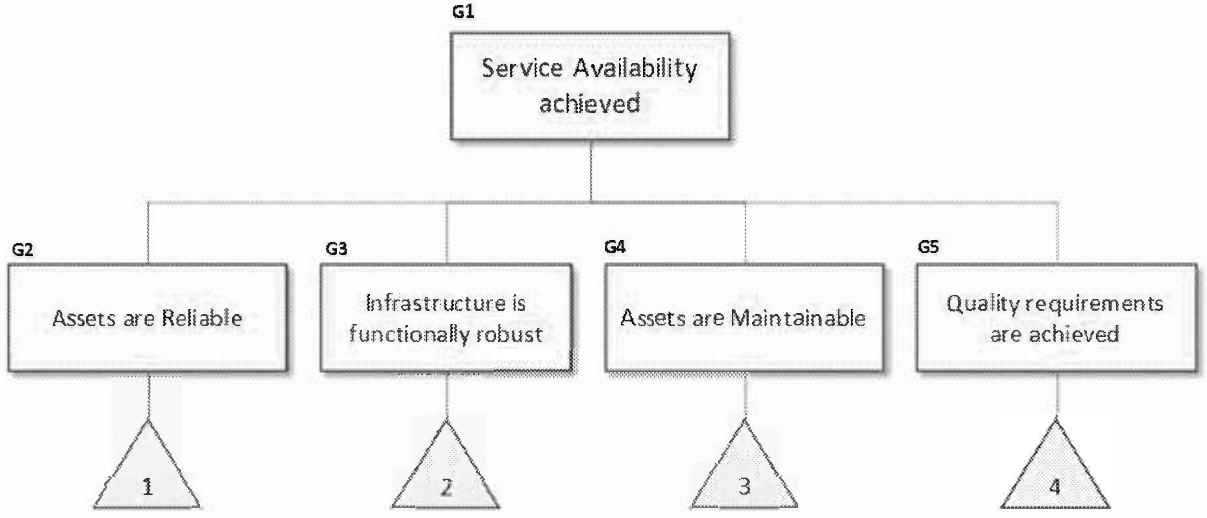
The recommendation to "deploy security to site in the event of detection" has been made against failures associated with systems supporting the safety and security of the infrastructure to the travelling public. Whilst the operational response to such failures is outside the scope and remit of this report, the final support decision making has a bearing on the level of residual risk. It is recommended that personnel be made available to ensure rapid response to failures, assistance to passengers and oversight to the live running of OLRT particularly in the early stages of operation.

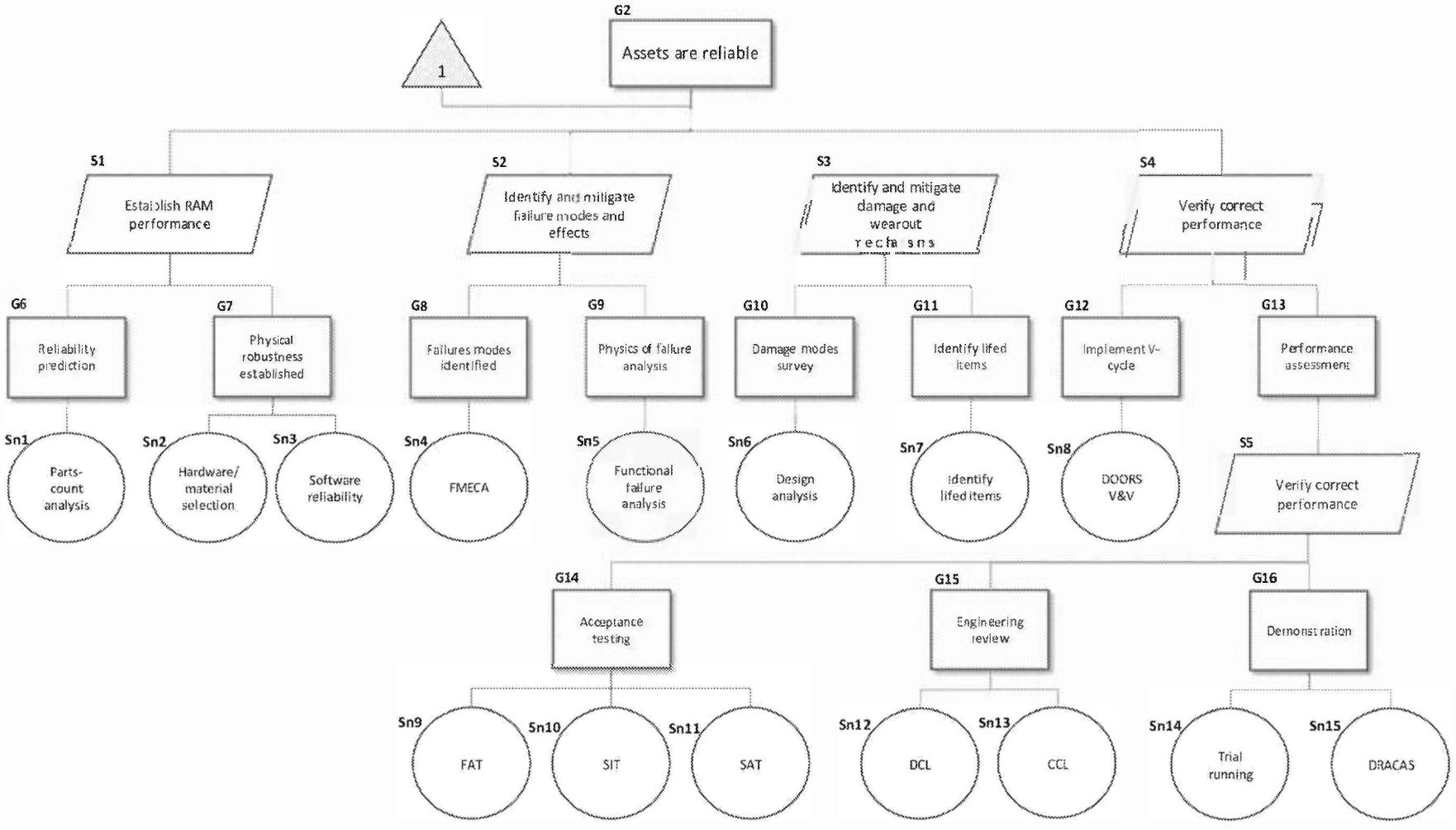
11. CONCLUSIONS

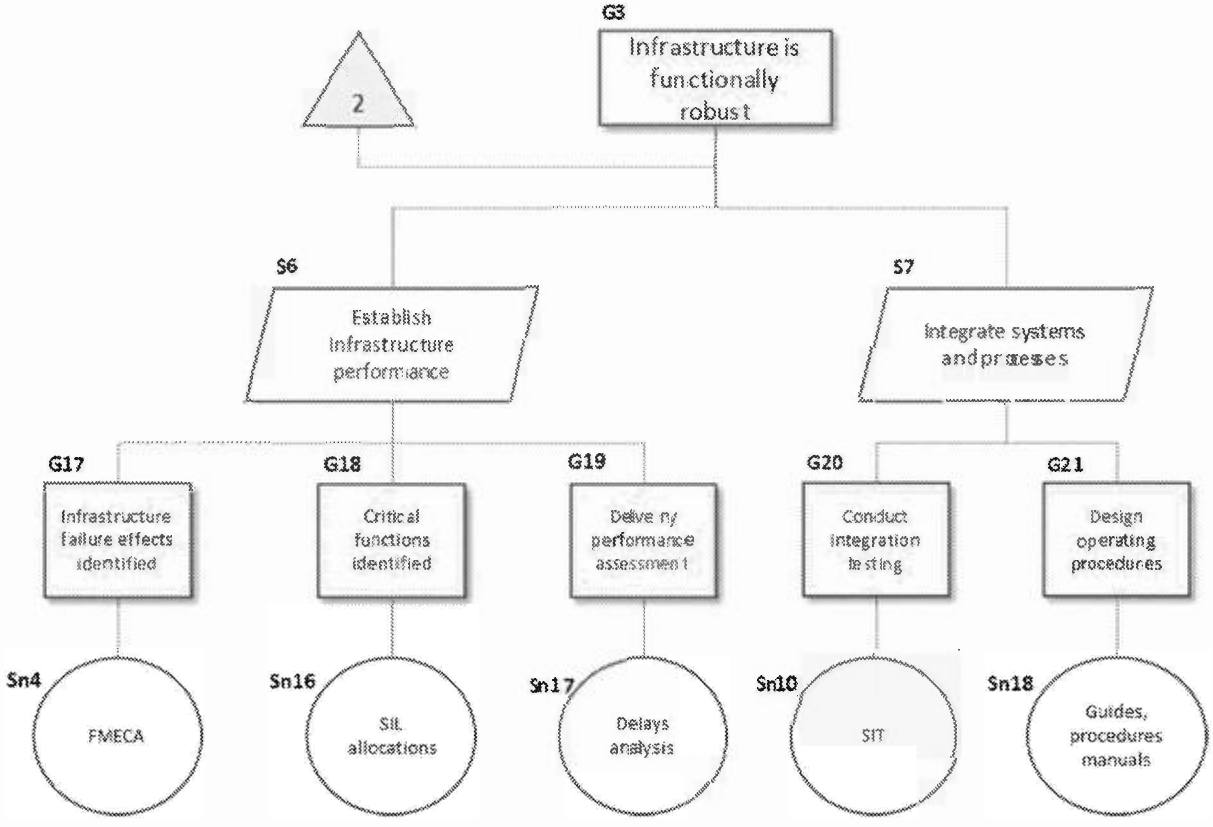
The following conclusions are made as a consequence of the analysis:

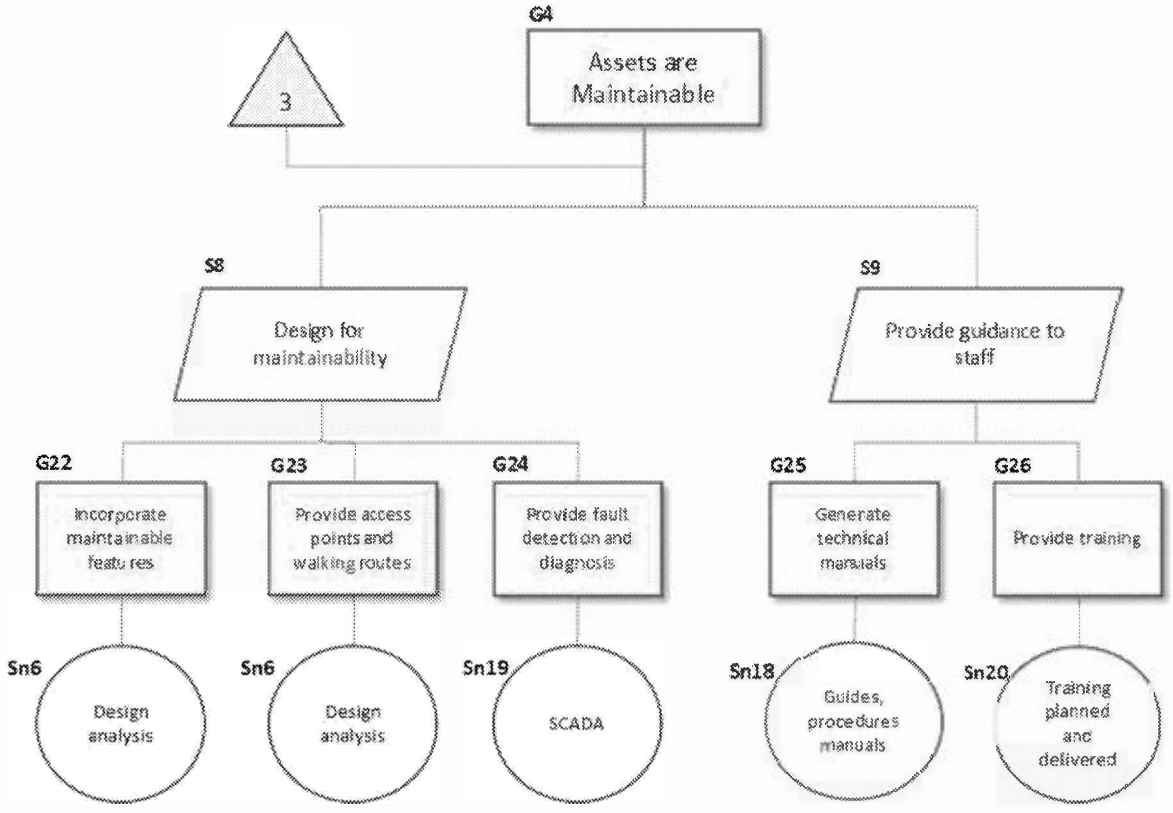
- A detailed RAM assessment has been conducted and is considered to provide evidence that OLRT infrastructure is capable of offering long term reliable performance
- The delivered EJV solution is either compliant to the PA related RAM requirements identified in Appendix Corwith compliance pending
- RAM related risks have been mitigated by the selection of robust and proven hardware and software that has been integrated into an infrastructure solution that is maintainable and suitable for the onset of trial running
- An operational availability of 99.07% was calculated based upon RBD modelling. This represented the probability of being able to successfully complete a journey between any two stations without delay
- Approximately 87 services would be delayed per year based upon FMEA modelling
- Goals identified in the GSN structure of the RAM case have been adequately fulfilled
- The above statements remain true on provision that systems and operational integration issues associated with TVS are rectified prior to the onset of operational services
- EJV derived RAM subsystem RAM Reports, upon which this report has been based, incorporate a high degree of inaccurate data (asset population) and incorrect or incomplete modelling (failure analysis). This analysis has set out of correct, complete and integrated existing analyses. The consequence of this is that performance in practice is expected to be considerably better than implied by the sub-systems analysis.

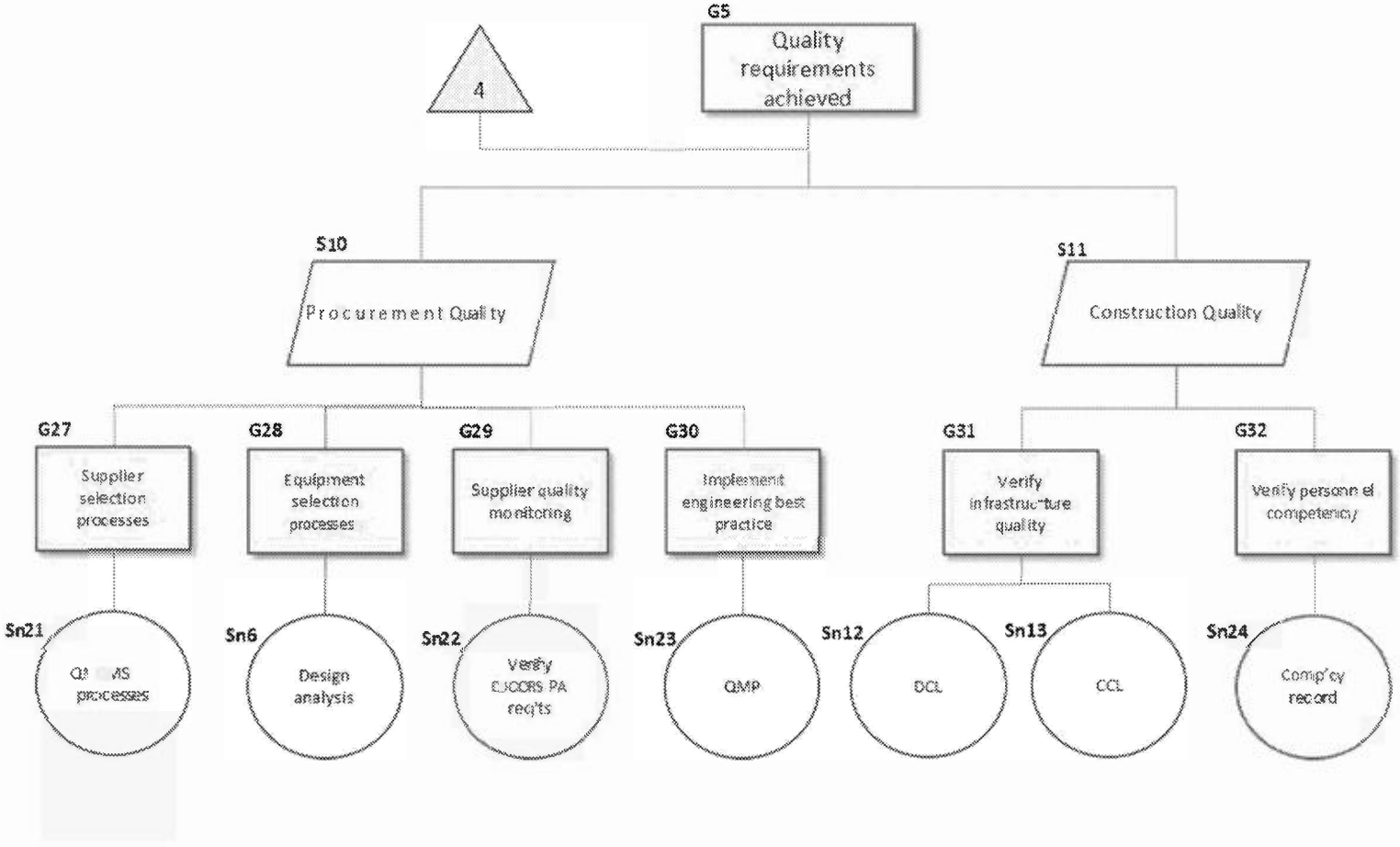
APPENDIX A – RAM GSN ARGUMENT








G4
Assets are Maintainable
3
S8
Design for maintainability
S9
Provide guidance to staff
G22
Incorporate maintainable features
G23
Provide access points and walking routes
G24
Provide fault detection and diagnosis
G25
Generate technical manuals
G26
Provide training
Sn6
Design analysis
Sn6
Design analysis
Sn19
SCADA
Sn18
Guides, procedures manuals
Sn20
Training planned and delivered



APPENDIX B – RAM GSN EVIDENCE CROSS REFERENCE

Ind.	Sn. No.	Sn. Description	Evidence
G2	Sn1	Parts-count analysis	Parts count reliability prediction conducted as shown in Annex D with the results shown in Table 7. The calculated MTBF values are considered to be satisfactory and individual subsystem reliability risks are considered to have been mitigated.
	Sn2	Hardware/material selection	Proven and type approved commercially available hardware that has been demonstrated to undergo long term reliable operations has been selected for use as described in section 2.4. Hardware has been integrated and controlled through accredited configuration control process with interfaces tracked within design Interface Control Documents (ICD) and verified through Systems Integration Tests (SIT).
	Sn3	Software reliability	Software has been integrated and controlled through accredited configuration control processes with interfaces tracked within design Interface Control Documents (ICD) and verified through Systems Integration Tests (SIT).
	Sn4	FMEA	FMEA modelling has been conducted and is shown in Annex E with the output results shown in section 8.It is considered that the FMEA provides evidence that failure modes have been adequately managed and that the infrastructure configuration is capable of delivering acceptable service delivery performance.
	Sn5	Functional failure analysis	Functional failure analysis has been conducted in detail within the FMEA, EJV FMEAS and within the Interface Hazard Analysis (IHA). It is considered that the output from these analyses provides confidence that functional failures have been identified and mitigated.
	Sn6	Design analysis	Detailed design analysis has been implemented through the project to achieve reliable design. This has been by implementing engineering best practice, conducting RAM assessment on individual assets or infrastructure, or by implementing robust quality processes.
	Sn7	Identify lifed items	Any life limited items have been identified and preventive maintenance requirements highlighted and scheduled.

Ind.	Sn. No.	Sn. Description	Evidence
	Sn8	DOORSV&V	PA requirements have been generated, flowed down to the supply chain and actively verified and validated within DOORS.
	Sn9	FAT	Assets have been demonstrated to provide acceptable levels of performance and reliability based upon qualification and factory acceptance testing and supplemented by demonstrated performance for COTS items.
	Sn10	SIT	Systems integration testing is successfully performed to verify correction functionality and operation.
	Sn11	SAT	Systems acceptance testing is successfully performed to verify correction functionality and operation.
	Sn12	DCL	Design conformance letters have been authorised and agreed.
	Sn13	CCL	Construction conformance letters have been authorised and agreed.
	Sn14	Trial Running	Trial running is implemented to verify correct functionality and reliable operation.
	Sn15	DRACAS	DRACAS processes have been implemented to identify and rectify design, manufacture and construction anomalies and implement processes to ensure lessons are learnt and ensure continuous improvement within the maintenance and operations teams.
G3	Sn4	FMEA	FMEA modelling has been conducted and is shown in Annex E with the output results shown in section 8. It is considered that the FMEA provides evidence that failure modes have been adequately managed and that the infrastructure configuration is capable of delivering acceptable service delivery performance.
	Sn16	Functional criticality and SIL allocation	Functional criticality considered within the FMEA modelling. SIL allocation identified within OLRT systems SIL allocation report.
	Sn17	Delay analysis	Delay analysis conducted as part of the FMEA modelling and discussed in section 8.2
	Sn10	SIT	Systems integration testing is successfully performed to verify correct functionality and operation.

Ind.	Sn. No.	Sn. Description	Evidence
	Sn18	Guides, procedures and manuals	Necessary technical publications, manuals, operating instructions and technical guidance has been provided to support the maintenance organisation.
G4	Sn6	Design analysis	Detailed design analysis has been implemented through the project to achieve reliable design. This has been by implementing engineering best practice, conducting RAM assessment on individual assets or infrastructure, or by implementing robust quality processes.
	Sn6	Design analysis	Detailed design analysis has been implemented through the project to achieve reliable design. This has been by implementing engineering best practice, conducting RAM assessment on individual assets or infrastructure, or by implementing robust quality processes.
	Sn19	SCADA	Implementation of SCADA functionality will provide the OLRT infrastructure with significant benefits in terms of operating performance and long-term cost effectiveness by allowing for swift isolation, diagnosis and rectification of faults of allowing for the migration to a predictive maintenance regime.
	Sn18	Guides, procedures and manuals	Comprehensive amounts of technical publications, operating instructions and maintenance instructions have been provided in support of the OLRT program.
	Sn20	Training plans and delivery	Maintenance personnel will be provided with sufficient support to enable them to do a good job and maintain the infrastructure to the necessary levels of quality and reliability. OLRT support the training programme but training is outside the scope of this report.
G5	Sn.21	QMS processes	OLRT quality processes have been detailed in a quality management plan and implemented throughout the programme to date.
	Sn.6	Design analysis	Detailed design analysis has been implemented throughout the project to achieve a reliable design. This has been by implementing engineering best practice, conducting RAM assessment on individual assets or infrastructure, or by implementing robust quality processes.

Ind.	Sn. No.	Sn. Description	Evidence
	Sn.22	Specify and Verify PA Requirements	PA requirements have been generated, flowed down to the supply chain and actively verified and validated within DOORS.
	Sn.23	QMP	OLRT quality process have been detailed in a quality management plan and implemented through the programme to date.
	Sn.12	DCL	Design conformance letters have been authorised and agreed.
	Sn.13	CCL	Construction conformance letters have been authorised and agreed.
	Sn.24	Competency record	Engineering personnel associated with the design and construction of OLRT are adequately skilled, competent and capable of performing the required activity.

APPENDIX C – RAM PREDICTIONS

Ref.	System	Description	QPU	MTBF (hrs)	FR A	Total MTBF	A x QTY	Data Source	Logistic	Access	Isolation	Remove & Replace	Alignment	Test	TOTAL	Availability
1.1	TVS	TVS AUXILIARY PANEL	1	2.87E+06	0.35	2.87E+06	0.35	NPRD-2016 P2113-62	0.25	0.25	0.25	4.00	0.05	0.25	5.05	0.99999824
1.2	TVS	JET FAN	3	1.13E+04	88.56	3.76E+03	265.67	Calculated	0.25	1.75	1.75	6.00	0.05	1.75	11.55	0.99897820
1.2.1	TVS	JET FAN ASSEMBLY	1	1.00E+05	10.00	1.00E+05	10.00	Calculated	0.25	0.25	0.25	6.00	0.05	0.25	7.05	0.99992950
1.2.1.1	TVS	MOTOR	1	2.57E+04	38.97	2.57E+04	38.97	Demonstrated field data	0.25	0.25	0.25	6.00	0.05	0.25	7.05	0.99972537
1.2.1.2	TVS	IMPELLER	1	2.02E+04	49.59	2.02E+04	49.59	Demonstrated field data	0.25	0.25	0.25	1.00	0.05	0.25	2.05	0.99989835
1.2.2	TVS	TEMPERATURE SENSOR	1	2.00E+05	5.00	2.00E+05	5.00	Engineering Judgement	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999225
1.2.3	TVS	VIBRATION MONITOR	1	2.00E+05	5.00	2.00E+05	5.00	Engineering Judgement	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999225
1.2.4	TVS	ANTI-CONDENSATION HEATERS	1	1.20E+05	8.33	1.20E+05	8.33	Engineering Judgement	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99998708
1.2.5	TVS	FERRO-RESONANCE TRANSFORMER	1	1.00E+05	10.00	1.00E+05	10.00	Engineering Judgement	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99998450
1.3	TVS	AXIAL FLOW FAN	4	2.97E+04	33.72	7.41E+03	134.87	Calculated	0.25	1.50	1.50	4.00	0.05	1.50	8.80	0.99970338
1.3.1	TVS	AXIAL FLOW FAN ASSEMBLY	1	1.00E+05	10.00	1.00E+05	10.00	Calculated	0.25	0.25	0.25	1.00	0.05	0.25	2.05	0.99997950
1.3.1.1	TVS	MOTOR	1	6.76E+04	14.79	6.76E+04	14.79	Demonstrated field data	0.25	0.25	0.25	1.00	0.05	0.25	2.05	0.99996969
1.3.1.2	TVS	IMPELLER	1	5.28E+04	18.93	5.28E+04	18.93	Demonstrated field data	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99997066
1.3.2	TVS	TEMPERATURE SENSOR	1	2.00E+05	5.00	2.00E+05	5.00	Engineering Judgement	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999225
1.3.3	TVS	VIBRATION MONITOR	1	2.00E+05	5.00	2.00E+05	5.00	Engineering Judgement	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999225
1.3.4	TVS	ANTI-CONDENSATION HEATERS	1	1.20E+05	8.33	1.20E+05	8.33	Engineering Judgement	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99998708
1.4	TVS	FAN ISOLATION DAMPER	4	5.81E+05	1.72	1.45E+05	6.88	OEM Data	0.25	2.50	2.50	4.00	0.05	0.25	9.55	0.99998358
1.4.1	TVS	FAN ISOLATION DAMPER ASSEMBLY	1	2.06E+06	0.49	2.06E+06	0.49	Calculated	0.25	2.50	2.50	0.50	0.05	0.25	6.05	0.99999706
1.4.1.1	TVS	BEARING	24	1.64E+08	0.01	6.85E+06	0.15	Calculated	0.25	2.50	2.50	2.00	0.05	0.25	7.55	0.99999995
1.4.1.2	TVS	SHAFT	12	1.23E+08	0.01	1.03E+07	0.10	Calculated	0.25	2.50	2.50	0.50	0.05	0.25	6.05	0.99999995
1.4.1.3	TVS	LINKAGE	1	8.22E+06	0.12	8.22E+06	0.12	Calculated	0.25	2.50	2.50	0.50	0.05	0.25	6.05	0.99999926
1.4.1.4	TVS	BLADE	24	2.47E+08	0.00	1.03E+07	0.10	Calculated	0.25	2.50	2.50	1.00	0.05	0.25	6.55	0.99999997
1.4.1.5	TVS	FAN BODY	1	4.11E+07	0.02	4.11E+07	0.02	Calculated	0.25	2.50	2.50	4.00	0.05	0.25	9.55	0.99999977
1.4.1.6	TVS	ACTUATOR	1	1.09E+06	0.92	1.09E+06	0.92	Calculated	0.25	2.50	2.50	6.00	0.05	0.25	11.55	0.99998941
1.4.2	TVS	JUNCTION BOX	1	1.20E+06	0.83	1.20E+06	0.83	Engineering Judgement	0.25	2.50	2.50	0.50	0.05	0.25	6.05	0.99999496
1.4.3	TVS	DAMPER WIRING	1	2.50E+06	0.40	2.50E+06	0.40	Engineering Judgement	0.25	2.50	2.50	1.00	0.05	0.25	6.55	0.99999738
1.5	TVS	MOTOR CONTROL CENTRE	1	3.97E+05	2.52	3.97E+05	2.52	IEEE T493 Table T10-4-141	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999609
1.6	TVS	PROGRAMMABLE LOGIC CONTROLLER	2	5.14E+05	1.95	2.57E+05	3.89	OEM Data	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999698
1.6.1	TVS	AC POWER SUPPLY	2	1.83E+07	0.05	9.17E+06	0.11	OEM Data	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999992
1.6.2	TVS	PROCESSOR	2	3.72E+05	2.69	1.86E+05	5.38	OEM Data	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999583
1.6.3	TVS	BRIDGE MODULE (2 PORTS)	6	5.08E+05	1.97	8.46E+04	11.82	OEM Data	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999695
1.6.4	TVS	ETHERNET MODULE	2	1.31E+06	0.76	6.56E+05	1.52	OEM Data	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999882
1.6.5	TVS	REDUNDANCY MODULE	2	2.50E+05	4.00	1.25E+05	7.99	OEM Data	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999380
1.6.6	TVS	CABLE, REDUNDANCY MODULE	1	1.00E+08	0.01	1.00E+08	0.01	Engineering Judgement	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999998
1.6.7	TVS	PATCH CABLE	2	1.00E+08	0.01	5.00E+07	0.02	Engineering Judgement	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999998
1.6.8	TVS	X7 SLOTCHASSIS	1	2.27E+07	0.04	2.27E+07	0.04	OEM Data	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999993
1.6.9	TVS	X13 SLOTCHASSIS	1	2.27E+07	0.04	2.27E+07	0.04	OEM Data	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999993
1.6.10	TVS	X17 SLOTCHASSIS	2	2.27E+07	0.04	1.13E+07	0.09	OEM Data	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999993
1.6.11	TVS	REDUNDANT POWER SUPPLY (REDUNDANT)	4	1.41E+06	0.71	3.53E+05	2.83	OEM Data	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999890
1.6.12	TVS	CHASSIS ADAPTOR MODULE, REDUNDANT POWER SUPPLY	2	3.85E+07	0.03	1.92E+07	0.05	OEM Data	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999996
1.6.13	TVS	CABLE, REDUNDANT POWER SUPPLY	4	1.00E+08	0.01	2.50E+07	0.04	Engineering Judgement	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999998
1.6.14	TVS	CABLE	2	1.00E+08	0.01	5.00E+07	0.02	OEM Data	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999998
1.6.15	TVS	SLOT FILLER	13	1.00E+08	0.01	7.69E+06	0.13	OEM Data	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999998
1.6.16	TVS	ISOLATED INPUT	11	2.08E+07	0.05	1.89E+06	0.53	OEM Data	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999993
1.6.17	TVS	JUMPER BAR	1	1.00E+08	0.01	1.00E+08	0.01	OEM Data	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999998
1.6.18	TVS	ISOLATED RELAY OUTPUT	11	6.06E+06	0.17	5.51E+05	1.82	OEM Data	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999974

Ref.	System	Description	QPU	MTBF (hrs)	FR λ	Total MTBF	λ x QTY	Data Source	Logistic	Access	Isolation	Remove & Replace	Alignment	Test	TOTAL	Availability
1.6.19	TVS	ANALOGE INPUT MODULE	1	1.90E+06	0.53	1.90E+06	0.53	OEM Data	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999918
1.6.20	TVS	X36 PIN CLAMPBLOCK	23	1.00E+08	0.01	4.35E+06	0.23	Engineering Judgement	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999998
1.6.21	TVS	MEDIA CONVERTER	2	9.97E+05	1.00	4.98E+05	2.01	OEM Data	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999845
1.6.22	TVS	N+1 REDUNDANTPS, AC230V/115V, DC210…375V,24VDC/SA	2	4.80E+05	2.08	2.40E+05	4.17	OEM Data	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999677
1.6.23	TVS	CIRCUIT BREAKER, 20A	1	1.00E+06	1.00	1.00E+06	1.00	Engineering Judgement	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999845
1.6.24	TVS	CIRCUIT BREAKER, 10A	3	1.00E+06	1.00	3.33E+0S	3.00	Engineering Judgement	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999845
1.6.25	TVS	CIRCUIT BREAKER, SA	6	1.00E+06	1.00	1.67E+0S	6.00	Engineering Judgement	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999845
1.6.26	TVS	CIRCUIT BREAKER, 2A	12	1.00E+06	1.00	8.33E+04	12.00	Engineering Judgement	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999845
1.6.27	TVS	ETHERNET/IP COPPER PORT	1	1.00E+06	1.00	1.00E+06	1.00	Engineering Judgement	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999845
1.7	TVS	TUNNEL VENTILATION CONTROL PANEL	1	1.65E+06	0.61	1.65E+06	0.61	IEEE T493 Table T10-4-111	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999906
1.8	TVS	TVS FIRE COMMAND POST	1	1.65E+06	0.61	1.65E+06	0.61	IEEE T493 Table T10-4-111	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999906
1.9	TVS	TVS MARSHALLING PANEL	1	1.65E+06	0.61	1.65E+06	0.61	IEEE T493 Table T10-4-111	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999906
1.10	TVS	VARIABLE FREQUENCY DRIVE	1	1.78E+05	5.63	1.78E+05	5.63	NPRD-2016 P2014-17	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999127
1.11	TVS	UNTERRUPTED POWER SUPPLY (UPS)	1	4.28E+04	23.36	4.28E+04	23.36	NPRD-2016 P2293-68	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99996379
1.11.1	TVS	ELECTRICAL DISTRIBUTION	1	2.87E+06	0.35	2.87E+06	0.35	NPRD-2016 P945-37	0.25	0.25	0.25	2.00	0.05	0.25	3.05	0.99999894
1.11.2	TVS	STATION TRANSFORMER	1	1.75E+08	0.01	1.75E+08	0.01	IEEE T493 Table T10-4-337	0.25	0.25	0.25	2.00	0.05	0.25	3.05	0.99999998
1.11.3	TVS	AC SWITCHGEAR	1	2.32E+06	0.43	2.32E+06	0.43	IEEE T493 Table T10-4-317	0.25	0.25	0.25	2.00	0.05	0.25	3.05	0.99999868
1.11.4	TVS	DISTRIBUTION PANEL	1	7.88E+05	1.27	7.88E+05	1.27	IEEE T493 Table T10-4-113	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999803
1.11.5	TVS	AUTOTRANSFORMER SWITCH	1	2.75E+0S	3.64	2.75E+05	3.64	IEEE T493 Table T10-4-287	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999436
1.11.6	TVS	DISTRIBUTION PANEL	1	4.66E+05	2.14	4.66E+0S	2.14	IEEE T493 Table T10-4-117	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999668
1.12	TVS	TUNNEL EXTRACTION DAMPER	3	7.13E+05	1.40	2.38E+05	4.21	OEM Data	0.25	0.25	0.25	4.00	0.05	0.25	5.05	0.99999291
1.13	TVS	GRADE LEVEL DAMPER	3	7.13E+05	1.40	2.38E+05	4.21	OEM Data	0.25	0.25	0.25	4.00	0.05	0.25	5.05	0.99999291
1.14	TVS	STATION EXTRACTION DAMPER	3	7.13E+0S	1.40	2.38E+05	4.21	OEM Data	0.25	0.25	0.25	4.00	0.05	0.25	5.05	0.99999291
2.1.1	TPS AC SWITCHGEAR	FEEDER BREAKER CELL	4	1.08E+06	0.93	2.70E+05	3.71	IEEE-493 table T10-4-309	0.25	0.25	0.25	4.00	0.05	0.25	5.05	0.99998128
2.1.2	TPS AC SWITCHGEAR	LOWER BREAKER CELL KIT	4	2.55E+06	0.39	6.38E+05	1.57	IEEE-493 table T10-4-88	0.25	0.25	0.25		0.05		0.80	0.99999875
2.1.3	TPS AC SWITCHGEAR	MOC AND TOC SWITCH	4	2.83E+06	0.35	7.08E+05	1.41	NPRD-2016 P2011-19	0.25	0.25	0.25	2.00	0.05	0.25	3.05	0.99999569
2.1.4	TPS AC SWITCHGEAR	CB MANUAL RACKING CRANK	1	5.74E+06	0.17	5.74E+06	0.17	NPRD-2016 P1982-13	0.25	0.25	0.25	2.00	0.05	0.25	3.05	0.99999947
2.1.5	TPS AC SWITCHGEAR	SPRING CHARGE CRANK FOR BREAKER	1	2.46E+06	0.41	2.46E+06	0.41	NPRD-2016 P2692-54	0.25	0.25	0.25		0.05		0.80	0.99999967
2.1.6	TPS AC SWITCHGEAR	38KV PT TRUCK ASSEMBLY	1	1.07E+05	9.34	1.07E+05	9.34	IEEE-493 table T10-4-163	0.25	0.25	0.25		0.05		0.80	0.99999253
2.1.7	TPS AC SWITCHGEAR	FUSE 38 KV 1.0E AMP	3	1.07E+05	9.34	3.57E+04	28.03	IEEE-493 table T10-4-163	0.25	0.25	0.25		0.05		0.80	0.99997758
2.1.8	TPS AC SWITCHGEAR	TRANSFORMER PRIMRY 115V SECDRY 1S0KV	2	1.75E+08	0.01	8.76E+07	0.01	IEEE-493 table T10-4-337	0.25	0.25	0.25	6.00	0.05	0.25	7.05	0.99999992
2.1.9	TPS AC SWITCHGEAR	CURRENT TRANSFORMER	12	1.75E+08	0.01	1.46E+07	0.07	IEEE-493 table T10-4-337	0.25	0.25	0.25	6.00	0.05	0.25	7.05	0.99999952
2.1.10	TPS AC SWITCHGEAR	SURGE ARRESTER 36KV	3	6.64E+06	0.15	2.21E+06	0.45	IEEE-493 table T10-4-17	0.25	0.25	0.25	1.00	0.05	0.25	2.05	0.99999907
2.1.11	TPS AC SWITCHGEAR	AC VOLTMETER 0-36KV VOLT	1	1.15E+05	8.68	1.15E+05	8.68	Engineering Judgement	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99998655
2.1.12	TPS AC SWITCHGEAR	AC AMMETER 0-200 AMP	2	8.48E+05	1.18	4.24E+05	2.36	Engineering Judgement	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999634
2.1.13	TPS AC SWITCHGEAR	AMMETER TRANSFER SWITCH	4	8.48E+0S	1.18	2.12E+05	4.72	Engineering Judgement	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999269
2.1.14	TPS AC SWITCHGEAR	VOLTMETER SWITCH	1	1.39E+06	0.72	1.39E+06	0.72	IEEE-493 table T10-4-285	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999889
2.1.15	TPS AC SWITCHGEAR	RELAY LOCKOUT	4	4.75E+05	2.10	1.19E+05	8.42	NPRD-2016 P2417-11	0.25	0.25	0.25	1.00	0.05	0.25	2.05	0.99998275
2.1.16	TPS AC SWITCHGEAR	CONTROL SWITCH, BREAKER	4	3.32E+06	0.30	8.30E+05	1.20	NPRD-2016 P2883-26	0.25	0.25	0.25	1.00	0.05	0.25	2.05	0.99999753
2.1.17	TPS AC SWITCHGEAR	INTERRUPTER SWITCH 38KV,	1	2.25E+05	4.45	2.25E+05	4.45	NPRD-2016 P2899-39	0.25	0.25	0.25	1.00	0.05	0.25	2.05	0.99999088
2.1.18	TPS AC SWITCHGEAR	POWER METER TRIPLE DISPLAY	1	7.96E+05	1.26	7.96E+05	1.26	Engineering Judgement	0.25	0.25	0.25	1.00	0.05	0.25	2.05	0.99999743
2.1.19	TPS AC SWITCHGEAR	SHORTING BLOCK 6 POINT	13	1.11E+09	0.00	8.SSE+07	0.01	NPRD-2016 P2971-40	0.25	0.25	0.25		0.05		0.80	0.99999999
2.1.20	TPS AC SWITCHGEAR	TEST SWITCH SERIES	4	2.37E+06	0.42	5.91E+05	1.69	NPRD-2016 P2924-64	0.25	0.25	0.25		0.05		0.80	0.99999865
2.1.21	TPS AC SWITCHGEAR	CIRCUIT BREAKER, UL1077, 5A	7	6.64E+06	0.15	9.48E+0S	1.05	Engineering Judgement	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999837
2.1.22	TPS AC SWITCHGEAR	CIRCUIT BREAKER, UL1077, 30A	4	6.64E+06	0.15	1.66E+06	0.60	Engineering Judgement	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999907
2.1.23	TPS AC SWITCHGEAR	CIRCUIT BREAKER, UL1077, 15A	4	1.25E+06	0.80	3.12E+0S	3.21	Engineering Judgement	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999503
2.1.24	TPS AC SWITCHGEAR	CONTROL SWITCH	5	2.87E+06	0.35	5.74E+0S	1.74	NPRD-2016 P2902-1	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999730
2.1.25	TPS AC SWITCHGEAR	GREEN LED PILOT LIGHT	5	7.18E+06	0.14	1.44E+06	0.70	NPRD-2016 P1854-62	0.25	0.25	0.25	0.25	0.05	0.25	1.30	0.99999909
2.1.26	TPS AC SWITCHGEAR	RED LED PILOT LIGHT	5	7.18E+06	0.14	1.44E+06	0.70	NPRD-2016 P1854-62	0.25	0.25	0.25	0.25	0.05	0.25	1.30	0.99999909

Ref.	System	Description	QPU	MTBF (hrs)	FR A	Total MTBF	λ x QTY	Data Source	Logistic	Access	Isolation	Remove & Replace	Alignment	Test	TOTAL	Availability
2.1.27	TPS AC SWITCHGEAR	HYGROTHERM	1	5.19E+04	19.28	5.19E+04	19.28	NPRD-2016 P1752-6	0.25	0.25	0.25		0.05		0.80	0.99998458
2.1.28	TPS AC SWITCHGEAR	STRIP HEATER	12	7.26E+05	1.38	6.05E+04	16.54	NPRD-2016 P1668-14	0.25	0.25	0.25		0.05		0.80	0.99998677
2.1.29	TPS AC SWITCHGEAR	GENERAL PURPOSE RELAY	1	4.75E+05	2.10	4.75E+05	2.10	NPRD-2016 P2417-11	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999674
2.1.30	TPS AC SWITCHGEAR	CURRENT LIMITING FUSE	3	8.63E+04	11.59	2.88E+04	34.77	IEEE-493 table T10-4-165	0.25	0.25	0.25		0.05		0.80	0.99997218
2.1.31	TPS AC SWITCHGEAR	TRANSFORMER, CONTROL POWER	1	1.75E+08	0.01	1.75E+08	0.01	IEEE-493 table T10-4-337	0.25	0.25	0.25	2.00	0.05	0.25	3.05	0.99999998
2.1.32	TPS AC SWITCHGEAR	AC AMMETER 0-100 AMP	2	1.17E+05	8.53	5.86E+04	17.05	Engineering Judgement	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99997357
2.1.33	TPS AC SWITCHGEAR	PROTECTION RELAY	4	4.75E+05	2.10	1.19E+05	8.42	NPRD-2016 P2417-11	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99998696
2.1.34	TPS AC SWITCHGEAR	PUSHBUTTON, MOMENTARY	1	1.40E+05	7.12	1.40E+05	7.12	NPRD-2016 P2349-42	0.25	0.25	0.25		0.05		0.80	0.99999430
2.1.35	TPS AC SWITCHGEAR	AMBER LED PILOT LIGHT	4	7.18E+06	0.14	1.79E+06	0.56	NPRD-2016 P1854-62	0.25	0.25	0.25		0.05		0.80	0.99999955
2.1.36	TPS AC SWITCHGEAR	RTS BUS INSULATOR	16	2.37E+06	0.42	1.48E+05	6.76	NPRD-2016 P1817-62	0.25	0.25	0.25		0.05		0.80	0.99999459
2.1.37	TPS AC SWITCHGEAR	OFFSET HUB, INTERLOCKING	1	2.14E+04	46.72	2.14E+04	46.72	NPRD-2016 P1831-77	0.25	0.25	0.25		0.05		0.80	0.99996262
2.1.38	TPS AC SWITCHGEAR	INTERLOCK TRANSFER BAR	1	2.14E+04	46.72	2.14E+04	46.72	NPRD-2016 P1831-77	0.25	0.25	0.25		0.05		0.80	0.99996262
2.1.39	TPS AC SWITCHGEAR	INTERLOCK DOOR MOUJNT	2	2.14E+04	46.72	1.07E+04	93.45	NPRD-2016 P1831-77	0.25	0.25	0.25		0.05		0.80	0.99992525
2.1.40	TPS AC SWITCHGEAR	TERMINAL BLOCK	1	2.37E+06	0.42	2.37E+06	0.42	NPRD-2016 P2970-59	0.25	0.25	0.25		0.05		0.80	0.99999966
2.1.41	TPS AC SWITCHGEAR	DC-DC CONVERTER 125 VDC	1	1.18E+06	0.85	1.18E+06	0.85	NPRD-2016 P663-46	0.25	0.25	0.25		0.05		0.80	0.99999932
2.1.42	TPS AC SWITCHGEAR	DUAL COUNTER	1	8.33E+05	1.20	8.33E+05	1.20	NPRD-2016 P680-4	0.25	0.25	0.25		0.05		0.80	0.99999904
2.1.43	TPS AC SWITCHGEAR	CIRCUIT BREAKER, 15A,	1	1.18E+06	0.85	1.18E+06	0.85		0.25	0.25	0.25		0.05		0.80	0.99999932
2.1.44	TPS AC SWITCHGEAR	TEMPERATURE MONITORING RELAY	1	4.75E+05	2.10	4.75E+05	2.10	NPRD-2016 P2417-11	0.25	0.25	0.25		0.05		0.80	0.99999832
2.1.45	TPS AC SWITCHGEAR	GENERAL PURPOSE RELAY	4	1.07E+06	0.93	2.68E+05	3.73	NPRD-2016 P2417-16	0.25	0.25	0.25		0.05		0.80	0.99999701
2.1.46	TPS AC SWITCHGEAR	TEST CABINET	1	2.65E+06	0.38	2.65E+06	0.38	NPRD-2016 P410-53	0.25	0.25	0.25	1.00	0.05	0.25	2.05	0.99999923
2.1.47	TPS AC SWITCHGEAR	POTENTIAL TRANSFORMER	3	1.30E+05	7.68	4.34E+04	23.05	NPRD-2016 P3011-43	0.25	0.25	0.25		0.05		0.80	0.99998156
2.1.48	TPS AC SWITCHGEAR	POTENTIAL FUSES	3	4.57E+04	21.86	1.52E+04	65.58	NPRD-2016 P1502-12	0.25	0.25	0.25		0.05		0.80	0.99994754
2.1.49	TPS AC SWITCHGEAR	CURRENT TRANSFORMER	3	1.30E+05	7.68	4.34E+04	23.05	NPRD-2016 P3011-43	0.25	0.25	0.25		0.05		0.80	0.99998156
2.1.50	TPS AC SWITCHGEAR	KFL INTERLOCK	1	2.14E+04	46.72	2.14E+04	46.72	NPRD-2016 P1831-77	0.25	0.25	0.25		0.05		0.80	0.99996262
2.1.51	TPS AC SWITCHGEAR	GENERAL PURPOSE RELAY	2	1.07E+06	0.93	5.36E+05	1.87	NPRD-2016 P2417-16	0.25	0.25	0.25		0.05		0.80	0.99999851
2.2.1	TPS DC SWITCHGEAR	POWER RECTIFIER TRANSFORMER	1	4.31E+07	0.02	4.31E+07	0.02	OEM Data	0.25	0.25	0.25	4.00	0.05	0.25	5.05	0.99999988
2.2.2	TPS DC SWITCHGEAR	RECTIFIER CABINET	1	2.65E+06	0.38	2.65E+06	0.38	NPRD-2016 P410-53	0.25	0.25	0.25		0.05		0.80	0.99999970
2.2.3	TPS DC SWITCHGEAR	DC SWITCHGEAR	1	2.92E+06	0.34	2.92E+06	0.34	IEEE-493 table T10-4-313	0.25	0.25	0.25	6.00	0.05	0.25	7.05	0.99999759
2.2.4	TPS DC SWITCHGEAR	DC DISCONNECT AND BYPASS SWITCH	2	4.25E+06	0.24	2.13E+06	0.47	IEEE-493 table T10-4-293	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999927
2.2.5	TPS DC SWITCHGEAR	RAIL GROUNDING SWITCH	1	1.39E+06	0.72	1.39E+06	0.72	IEEE-493 table T10-4-285	0.25	0.25	0.25	1.00	0.05	0.25	2.05	0.99999853
2.3.1	TPS AISLE EQUIPEMENT	HVAC UNIT	2	2.12E+04	47.18	1.06E+04	94.36	Engineering Judgement	0.25	0.25	0.25		0.05		0.80	0.99992452
2.3.2	TPS AISLE EQUIPEMENT	EYE WASH STATION	1	7.15E+04	13.99	7.15E+04	13.99	NPRD-2016 P981-26	0.25	0.25	0.25		0.05		0.80	0.99998881
2.3.3	TPS AISLE EQUIPEMENT	RELAY AND LEDS, HYDROGEN MONITOR	1	3.25E+05	3.08	3.25E+05	3.08	NPRD-2016 P804-25	0.25	0.25	0.25		0.05		0.80	0.99999754
2.3.4	TPS AISLE EQUIPEMENT	EXHAUST FAN	1	2.93E+05	3.42	2.93E+05	3.42	NPRD-2016 P992-19	0.25	0.25	0.25	1.00	0.05	0.25	2.05	0.99999300
2.3.5	TPS AISLE EQUIPEMENT	FIRE EXTINGUISHER	2	2.00E+05	5.00	1.00E+05	9.99	NPRD-2016 P1408-64	0.25	0.25	0.25		0.05		0.80	0.99999201
2.3.6	TPS AISLE EQUIPEMENT	SMOKE DETECTOR	2	2.87E+06	0.35	1.44E+06	0.70	NPRD-2016 P1409-29	0.25	0.25	0.25		0.05		0.80	0.99999944
2.3.7	TPS AISLE EQUIPEMENT	BATTERY CHARGER	1	1.18E+06	0.85	1.18E+06	0.85	IEEE-493 table T10-4-69	0.25	0.25	0.25		0.05		0.80	0.99999932
2.3.7B	TPS AISLE EQUIPEMENT	BATTERIES	1	1.17E+06	0.85	1.17E+06	0.85	IEEE-493 table T10-4-24	0.25	0.25	0.25		0.05		0.80	0.99999932
2.3.8	TPS AISLE EQUIPEMENT	DC PANELBOARD	1	4.46E+05	2.24	4.46E+05	2.24	IEEE-493 table T10-4-117	0.25	0.25	0.25	2.00	0.05	0.25	3.05	0.99999317
2.3.9	TPS AISLE EQUIPEMENT	FIRE ALARM PANEL	1	2.87E+06	0.35	2.87E+06	0.35	NPRD-2016 P2113-62	0.25	0.25	0.25	2.00	0.05	0.25	3.05	0.99999894
2.3.10	TPS AISLE EQUIPEMENT	TELEPHONE	1	1.75E+05	5.70	1.75E+05	5.70	NPRD-2016 P2378-17	0.25	0.25	0.25		0.05		0.80	0.99999544
2.3.11	TPS AISLE EQUIPEMENT	EMERGENCY STOP PUSH BUTTON	2	1.40E+05	7.12	7.02E+04	14.24	NPRD-2016 P2349-42	0.25	0.25	0.25		0.05		0.80	0.99998861
2.3.12	TPS AISLE EQUIPEMENT	AC PANEL BOARD	1	2.55E+06	0.39	2.55E+06	0.39	IEEE-493 table T10-4-88	0.25	0.25	0.25	2.00	0.05	0.25	3.05	0.99999881
2.3.13	TPS AISLE EQUIPEMENT	HVAC SYSTEM 10 TON	1	2.12E+04	47.18	2.12E+04	47.18	Engineering Judgement	0.25	0.25	0.25		0.05		0.80	0.99996226
2.3.14	TPS AISLE EQUIPEMENT	ECONOMIZER, EQUIPMENT BUILDING	2	2.87E+06	0.35	1.44E+06	0.70	NPRD-2016 P63-65	0.25	0.25	0.25		0.05		0.80	0.99999944
2.3.15	TPS AISLE EQUIPEMENT	EXTERIOR LIGHT, TWF1	2	2.99E+06	0.33	1.50E+06	0.67	NPRD-2016 P1901-35	0.25	0.25	0.25		0.05		0.80	0.99999947
2.3.16	TPS AISLE EQUIPEMENT	EXIT SIGN AND EMERGENCY LIGHT	2	4.96E+04	20.17	2.48E+04	40.33	NPRD-2016 P1901-84	0.25	0.25	0.25		0.05		0.80	0.99996773
2.3.17	TPS AISLE EQUIPEMENT	LIGHT SWITCH 20A	2	8.61E+06	0.12	4.31E+06	0.23	NPRD-2016 P2887-77	0.25	0.25	0.25	0.50	0.05	0.25	1.55	0.99999964
2.4.1	TPS MISCELLANEOUS	PLC	1	6.06E+06	0.17	6.06E+06	0.17	OEM Data	0.25	0.25	0.25		0.05		0.80	0.99999987
2.4.2	TPS MISCELLANEOUS	NEGATIVE DISCONNECT SWITCH	1	2.75E+05	3.64	2.75E+05	3.64	IEEE-493 table T10-4-287	0.25	0.25	0.25		0.05		0.80	0.99999709

Ref.	System	Description	QPU	MTBF (hrs)	FR A	Total MTBF	A x QTY	Data Source	Logistic	Access	Isolation	Remove & Replace	Alignment	Test	TOTAL	Availability
2.4.3	TPS MISCELLANEOUS	MAIN DC BREAKER	1	4.17E+07	0.02	4.17E+07	0.02	IEEE-493 table T10-4-90	0.25	0.25	0.25		0.05		0.80	0.99999998
3.1	OCS- MAINLINE	POLE				#DIV/0!										#DIV/0!
3.1.1	OCS- MAINLINE	POLE - REGULAR (W/OUT DOWNGUY)	225	8.61E+06	0.12	3.83E+04	26.12	OCS_2-19	0.25	0.25	0.05	7.95	0.05		8.55	0.99977670
3.1.2	OCS- MAINLINE	POLE - WITH DOWNGUY	71	8.61E+06	0.12	1.21E+05	8.24	OCS_2-19	0.25	0.25	0.05	7.95	0.05		8.55	0.99992953
3.1.3	OCS- MAINLINE	POLE - WITH DUAL DOWNGUY	1	8.61E+06	0.12	8.61E+06	0.12	OCS_2-19	0.25	0.25	0.05	7.95	0.05		8.55	0.99999901
3.2.1	OCS- MAINLINE	POLE- BALANCE WEIGHT ASSEMBLY*	35	2.58E+07	0.04	7.38E+05	1.35	OCS_2-16	0.25	0.25	0.05	1.20	0.05		1.80	0.99999756
3.2.2	OCS- MAINLINE	POLE - FEEDER *	24	5.18E+07	0.02	2.16E+06	0.46	OCS_2-08	0.25	0.25	0.05	0.63	0.05		1.23	0.99999943
3.2.3	OCS- MAINLINE	POLE - FIXTERMASS *	42	1.00E+08	0.01	2.38E+06	0.42	Engineering Judgement	0.25	0.25	0.05	7.95	0.05		8.55	0.99999641
3.2.4	OCS- MAINLINE	POLE - MID POINT ANCHOR*	5	5.18E+07	0.02	1.04E+07	0.10	OCS_2-04	0.25	0.25	0.05	1.18	0.05		1.78	0.99999983
3.2.5	OCS- MAINLINE	POLE -SPRING TENSION ASSEMBLY*	11	2.58E+07	0.04	2.35E+06	0.43	OCS_2-16	0.25	0.25	0.05	1.20	0.05		1.80	0.99999923
3.2.6	OCS- MAINLINE	POLE - HEADGUY	4	5.18E+07	0.02	1.30E+07	0.08	OCS_2-04	0.25	0.25	0.05	1.18	0.05		1.78	0.99999986
3.2.7	OCS- MAINLINE	HEADSPANS	17	1.03E+08	0.01	6.06E+06	0.16	OCS_2-05	0.25	0.25	0.05	3.01	0.05		3.61	0.99999940
3.2.8	OCS- MAINLINE	HEADSPAN POLE (TOTAL)	34	1.03E+08	0.01	3.03E+06	0.33	OCS_2-05	0.25	0.25	0.05	3.01	0.05		3.61	0.99999881
3.2.9	OCS- MAINLINE	HEADSPAN POLE - REGULAR	28	1.03E+08	0.01	3.68E+06	0.27	OCS_2-05	0.25	0.25	0.05		0.05		0.60	0.99999984
3.2.10	OCS- MAINLINE	HEADSPAN POLE - WITH DOWNGUY	6	1.03E+08	0.01	1.72E+07	0.06	OCS_2-05	0.25	0.25	0.05	3.01	0.05		3.61	0.99999979
3.2.11	OCS- MAINLINE	HEADSPAN POLE - BALANCE WEIGHT ASSEMBLY*	4	1.03E+08	0.01	2.58E+07	0.04	OCS_2-05	0.25	0.25	0.05	3.01	0.05		3.61	0.99999986
3.2.12	OCS- MAINLINE	HEADSPAN POLE - DISCONNECT SWITCH*	4	1.03E+08	0.01	2.58E+07	0.04	OCS_2-05	0.25	0.25	0.05	3.01	0.05		3.61	0.99999986
3.2.13	OCS- MAINLINE	HEADSPAN POLE -FEEDER *	1	1.03E+08	0.01	1.03E+08	0.01	OCS_2-05	0.25	0.25	0.05	3.01	0.05		3.61	0.99999996
3.2.14	OCS- MAINLINE	HEADSPAN POLE -SPRING TENSION ASSEMBLY*	2	1.03E+08	0.01	5.15E+07	0.02	OCS_2-05	0.25	0.25	0.05	3.01	0.05		3.61	0.99999993
3.2.15	OCS- MAINLINE	SUPPORTS	1	3.57E+06	0.28	3.57E+06	0.28	OCS_3-03	0.25	0.25	0.05		0.05		0.60	0.99999983
3.2.16	OCS- MAINLINE	CROSS SPAN BEAM (AT LEAD TRACKS)	13	5.18E+07	0.02	3.99E+06	0.25	OCS_2-06	0.25	0.25	0.05	0.97	0.05		1.57	0.99999961
3.2.17	OCS- MAINLINE	DROP TUBE (AT STATION)	3	1.00E+08	0.01	3.33E+07	0.03	Engineering Judgement	0.25	0.25	0.05	1.00	0.05		1.60	0.99999995
3.2.18	OCS- MAINLINE	ELASTIC SUPPORT	6	1.00E+08	0.01	1.67E+07	0.06	Engineering Judgement	0.25	0.25	0.05	1.00	0.05		1.60	0.99999990
3.2.19	OCS- MAINLINE	ELASTIC SUPPORT WITH MW TRACKS)	4	1.00E+08	0.01	2.50E+07	0.04	Engineering Judgement	0.25	0.25	0.05	1.00	0.05		1.60	0.99999994
3.2.20	OCS- MAINLINE	SUPPORT FOR PULLEY ATTACHMENT (AT LEAD TRACKS)	4	3.57E+06	0.28	8.91E+05	1.12	OCS_3-03	0.25	0.25	0.05	1.12	0.05		1.72	0.99999807
3.2.21	OCS- MAINLINE	PULLEY SUPPORT	112	1.00E+08	0.01	8.93E+05	1.12	Engineering Judgement	0.25	0.25	0.05	1.00	0.05		1.60	0.99999821
3.3.1	OCS- OLRT-C & MVA POWER	DEVICES	1	1.00E+08	0.01	1.00E+08	0.01	Engineering Judgement	0.25	0.25	0.05	1.00	0.05		1.60	0.99999998
3.3.2	OCS- OLRT-C & MVA POWER	CONTACT BRIDGE	33	4.31E+06	0.23	1.31E+05	7.66	OCS_2-02	0.25	0.25	0.05	2.20	0.05		2.80	0.99997856
3.3.3	OCS -OLRT-C & MVA POWER	MOTORIZED DISCONNECT SWITCH (POLE)	15	5.04E+06	0.20	3.36E+05	2.98	T10-4-291	0.25	0.25	0.05	0.33	0.05		0.93	0.99999723
3.3.4	OCS- OLRT-C & MVA POWER	MOTORIZED DISCONNECT SWITCH (HEADSPAN POLE)	4	5.04E+06	0.20	1.26E+06	0.79	T10-4-291	0.25	0.25	0.05	0.33	0.05		0.93	0.99999926
3.3.5	OCS- OLRT-C & MVA POWER	JUMPERS	42	1.48E+07	0.07	3.52E+05	2.84	OCS_2-09	0.25	0.25	0.05	1.30	0.05		1.90	0.99999460
3.3.6	OCS- OLRT-C & MVA POWER	MW ANCHORS (AT TRANSITIONS TO RIGID RAIL, INCLUDES 2 CATENARY ANCHORS)	16	5.18E+07	0.02	3.24E+06	0.31	OCS_2-04	0.25	0.25	0.05	1.18	0.05		1.78	0.99999945
3.3.7	OCS OLRT-C & MVA POWER	ANCHOR (AT OVERPASS)	3	5.18E+07	0.02	1.73E+07	0.06	OCS_2-04	0.25	0.25	0.05	1.18	0.05		1.78	0.99999990
3.3.8	OCS- OLRT-C & MVA POWER	ANCHOR (WITHIN TUNNEL)	4	5.18E+07	0.02	1.30E+07	0.08	OCS_2-04	0.25	0.25	0.05	1.18	0.05		1.78	0.99999986
3.3.9	OCS- OLRT-C & MVA POWER	SECTION ISOLATOR	27	1.72E+07	0.06	6.39E+05	1.57	OCS_2-23	0.25	0.25	0.05	1.54	0.05		2.14	0.99999665
3.3.10	OCS -OLRT-C & MVA POWER	TUNNEL HEADSPAN ANCHOR (RIDEAU STN)	2	5.18E+07	0.02	2.59E+07	0.04	OCS_2 04	0.25	0.25	0.05	1.18	0.05		1.78	0.99999993
3.3.11	OCS- OLRT-C & MVA POWER	CANTILEVERS	1	8.61E+06	0.12	8.61E+06	0.12	OCS_2-12	0.25	0.25	0.05	1.30	0.05		1.90	0.99999978
3.3.12	OCS -OLRT-C & MVA POWER	HEADSPAN CANTILEVERS (STEADY ARMS)	40	8.61E+06	0.12	2.15E+05	4.64	OCS_2-12	0.25	0.25	0.05	1.30	0.05		1.90	0.99999118
3.3.13	OCS OLRT-C & MVA POWER	POLE CANTILEVERS (TOTAL)	455	8.61E+06	0.12	1.89E+04	52.82	OCS_2 19	0.25	0.25	0.05	1.50	0.05		2.10	0.99988909
3.3.14	OCS OLRT-C & MVA POWER	POLE CANTILEVERS - DUAL ARM	71	8.61E+06	0.12	1.21E+05	8.24	OCS_2-19	0.25	0.25	0.05	1.50	0.05		2.10	0.99998269
3.3.15	OCS- OLRT-C & MVA POWER	POLE CANTILEVERS- SINGLE ARM	384	8.61E+06	0.12	2.24E+04	44.58	OCS_2-19	0.25	0.25	0.05	1.50	0.05		2.10	0.99990639
3.3.16	OCS- OLRT-C & MVA POWER	POST CANTILEVERS (ALL SINGLE ARMS)	6	8.61E+06	0.12	1.44E+06	0.70	OCS_2-19	0.25	0.25	0.05	1.50	0.05		2.10	0.99999854
3.3.17	OCS OLRT-C & MVA POWER	STATION COLUMN CANTILEVERS (ALL SINGLE ARMS)	8	8.61E+06	0.12	1.08E+06	0.93	OCS_2 19	0.25	0.25	0.05	1.50	0.05		2.10	0.99999805
3.3.18	OCS- OLRT-C & MVA POWER	RIGID RAIL DEVICES	10	1.00E+08	0.00	1.00E+08	0.01	Engineering Judgement	0.25	0.25	0.05	1.50	0.05		2.10	0.99999998
3.3.19	OCS- OLRT-C & MVA POWER	ANCHORS	50	5.18E+07	0.02	1.04E+06	0.96	OCS_2-04	0.25	0.25	0.05	1.50	0.05		2.10	0.99999797
3.3.20	OCS OLRT-C & MVA POWER	EXPANSION	10	1.00E+08	0.00	1.00E+08	0.01	Engineering Judgement	0.25	0.25	0.05	1.50	0.05		2.10	0.99999998
3.3.21	OCS OLRT-C & MVA POWER	FEEDERS	4	5.18E+07	0.02	1.30E+07	0.08	OCS_2-08	0.25	0.25	0.05	1.50	0.05		2.10	0.99999984
3.3.22	OCS- OLRT-C & MVA POWER	RAMPS	10	1.00E+08	0.00	1.00E+08	0.01	Engineering Judgement	0.25	0.25	0.05	1.50	0.05		2.10	0.99999998

Ref.	System	Description	QPU	MTBF (hrs)	FR A	Total MTBF	λ x QTY	Data Source	Logistic	Access	Isolation	Remove & Replace	Alignment	Test	TOTAL	Availability
3.3.23	OCS-OLRT-C& MVA POWER	SUPPORTS	692	1.78E+07	0.06	2.58E+04	38.82	Engineering Judgement	0.25	0.25	0.05	1.50	0.05		2.10	0.99991848
3.3.24	OCS -OLRT-C & MVA POWER	SWITCHED OVERLAP (TUNNEL DISCONNECT SWITCH)	10	1.00E+08	0.00	1.00E+08	0.01	Engineering Judgement	0.25	0.25	0.05	1.50	0.05		2.10	0.99999998
3.3.25	OCS -OLRT-C & MVA POWER	TRANSITION RAILS	14	1.00E+08	0.00	7.14E+07	0.01	Engineering Judgement	0.25	0.25	0.05	1.50	0.05		2.10	0.99999997
3.3.26	OCS -OLRT-C & MVA POWER	LENGTHS	10	1.00E+08	0.00	1.00E+08	0.01	Engineering Judgement	0.25	0.25	0.05	1.50	0.05		2.10	0.99999998
3.3.27	OCS -OLRT-C & MVA POWER	LENGTH OCS	31267	1.00E+08	0.00	3.20E+06	0.31	Engineering Judgement	0.25	0.25	0.05	1.50	0.05		2.10	0.99999934
3.3.28	OCS- OLRT-C & MVA POWER	LENGTH RIGID RAIL	7736	1.00E+08	0.00	1.29E+07	0.08	Engineering Judgement	0.25	0.25	0.05	1.50	0.05		2.10	0.99999984
3.3.29	OCS -OLRT-C& MVA POWER	DROPPER	2500	1.00E+08	0.00	4.00E+07	0.03	Engineering Judgement	0.25	0.25	0.05	1.50	0.05		2.10	0.99999995
3.3.30	OCS -OLRT-C & MVA POWER	SURGE ARRESTORS	25	3.45E+07	0.03	1.38E+06	0.73	OCS_2-20	0.25	0.25	0.05	1.50	0.05		2.10	0.99999848
3.3.31	OCS- OLRT-C & MVA POWER	GROUNDING (FOUNDATION & SURGE ARRESTOR)	435	1.00E+11	0.00	2.30E+08	0.00	Engineering Judgement	0.25	0.25	0.05	1.50	0.05		2.10	0.99999999
3.3.32	OCS -OLRT-C & MVA POWER	POLE ID AND WARNING SIGN	1	1.00E+11	0.00	1.00E+11	0.00		0.25	0.25	0.05	1.50	0.05		2.10	1.00000000
3.3.33	OCS -OLRT-C & MVA POWER	FEEDER	1	5.18E+07	0.02	5.18E+07	0.02	OCS_2-08	0.25	0.25	0.05	1.50	0.05		2.10	0.99999996
4.1.01	STATION, AIR CONDITIONING	AIR CONDITIONING UNIT	2	2.12E+04	23.61	2.12E+04	47.22	Engineering Judgement	0.25	0.25	0.25	8.00	0.05		8.80	0.99958464
4.1.02	STATION, AIR CONDITIONING	ROOF TOP UNITS	2	2.12E+04	23.61	2.12E+04	47.22	Engineering Judgement	0.25	0.25	0.25	8.00	0.05		8.80	0.99958464
4.1.03	STATION, AIR CONDITIONING	MOTORIZED DAMPER	1	2.37E+06	0.42	2.37E+06	0.42	TVS system	0.25	0.25	0.25		0.05		0.80	0.99999966
4.1.04	STATION, AIR CONDITIONING	VAV BOX C/W SILENCER	1	8.09E+05	1.24	8.08E+0S	1.24	NPRD-2016 P1661-83	0.25	0.25	0.25	0.50	0.05		1.30	0.99999839
4.1.05	STATION, AIR CONDITIONING	VAV BOX C/W SILENCER AND BOOSTER HEATING COIL	1	8.09E+05	1.24	8.08E+05	1.24	NPRD-2016 P1661-83	0.25	0.25	0.25	0.50	0.05		1.30	0.99999839
4.1.06	STATION, AIR CONDITIONING	HEAT PUMP	1	6.45E+03	155.00	6.45E+03	155.00	NPRD-2016 P2402-28	0.25	0.25	0.25	1.00	0.05		1.80	0.99972108
4.1.07	STATION, AIR CONDITIONING	FAN COIL UNIT	1	2.93E+05	3.42	2.93E+0S	3.42	NPRD-2016 P992-19	0.25	0.25	0.25	1.00	0.05		1.80	0.99999385
4.1.08	STATION, AIR CONDITIONING	FAN	1	2.93E+0S	3.42	2.93E+0S	3.42	NPRD-2016 P992-19	0.25	0.25	0.25	1.00	0.05		1.80	0.99999385
4.1.09	STATION, AIR CONDITIONING	WALL MOUNTED FAN	1	2.93E+0S	3.42	2.93E+05	3.42	NPRD-2016 P992 19	0.25	0.25	0.25	1.00	0.05		1.80	0.99999385
4.1.10	STATION, AIR CONDITIONING	THERMOSTAT/ TEMPERATURE SENSOR	1	3.32E+04	30.11	3.32E+04	30.11	NPRD-2016 P2983-19	0.25	0.25	0.25	0.50	0.05		1.30	0.99996086
4.1.11	STATION, AIR CONDITIONING	VARIABLE SPEED CONTROLLER (115V)	1	2.10E+05	4.75	2.10E+05	4.75	NPRD-2016 P660-78	0.25	0.25	0.25		0.05		0.80	0.99999620
4.1.12	STATION, AIR CONDITIONING	HUMIDISTAT/ HUMIDITY SENSOR	1	5.74E+06	0.17	5.74E+06	0.17	NPRD-2016 P924-44	0.25	0.25	0.25	0.50	0.05		1.30	0.99999977
4.1.13	STATION, AIR CONDITIONING	GAS DETECTION SENSOR	1	2.87E+06	0.35	2.87E+06	0.35	NPRD-2016 P755-58	0.25	0.25	0.25	0.50	0.05		1.30	0.99999955
4.1.14	STATION, AIR CONDITIONING	CARBON MONOXIDE SENSOR	1	2.87E+06	0.35	2.87E+06	0.35	NPRD-2016 P755-58	0.25	0.25	0.25	0.50	0.05		1.30	0.99999955
4.1.15	STATION, AIR CONDITIONING	CARBON DIOXIDE SENSOR	1	2.87E+06	0.35	2.87E+06	0.35	NPRD-2016 P755-58	0.25	0.25	0.25	0.50	0.05		1.30	0.99999955
4.1.16	STATION, AIR CONDITIONING	OCCUPANCY SENSOR	1	2.87E+06	0.35	2.87E+06	0.35	NPRD-2016 P1692 9	0.25	0.25	0.25	0.50	0.05		1.30	0.99999955
4.1.17	STATION, AIR CONDITIONING	WATER HEATER (UH)	1	1.04E+06	0.96	1.04E+06	0.96	NPRD-2016 P1666-47	0.25	0.25	0.25	1.00	0.05		1.80	0.99999827
4.1.18	STATION, AIR CONDITIONING	HEATER, GAS UNIT HEATER (GUH)	1	2.37E+06	0.42	2.37E+06	0.42	NPRD-2016 P1665-31	0.25	0.25	0.25	1.00	0.05		1.80	0.99999924
4.1.19	STATION, AIR CONDITIONING	ELECTRIC UNIT HEATER (EUH)	1	2.14E+0S	4.68	2.14E+05	4.68	NPRD-2016 P1666-53	0.25	0.25	0.25		0.05		0.80	0.99999626
4.1.20	STATION, AIR CONDITIONING	HYDRONIC UNIT HEATER (HUH)	1	1.04E+06	0.96	1.04E+06	0.96	NPRD-2016 P1666-47	0.25	0.25	0.25	1.00	0.05		1.80	0.99999827
4.1.21	STATION, AIR CONDITIONING	HEATING COIL, BOOSTER HEATER	1	7.15E+04	13.99	7.15E+04	13.99	NPRD-2016 P1665-46	0.25	0.25	0.25	1.00	0.05		1.80	0.99997482
4.1.22	STATION, AIR CONDITIONING	2-WAY CONTROL VALVE	1	2.87E+06	0.35	2.87E+06	0.35	NPRD-2016 P1802-71	0.25	0.25	0.25	1.00	0.05		1.80	0.99999937
4.1.23	STATION, AIR CONDITIONING	3-WAY CONTROL VALVE	1	2.87E+06	0.35	2.87E+06	0.35	NPRD 2016 P1802-71	0.25	0.25	0.25	1.00	0.05		1.80	0.99999937
4.1.24	STATION, AIR CONDITIONING	BUTTERFLY VALVE	1	2.87E+06	0.35	2.87E+06	0.35	NPRD-2016 P1802-71	0.25	0.25	0.25	1.00	0.05		1.80	0.99999937
4.1.25	STATION, AIR CONDITIONING	TWO-WAY CONTROL VALVE	1	2.87E+06	0.35	2.87E+06	0.35	NPRD-2016 P1802-71	0.25	0.25	0.25	1.00	0.05		1.80	0.99999937
4.1.26	STATION, AIR CONDITIONING	THREE-WAY CONTROL VALVE	1	2.87E+06	0.35	2.87E+06	0.35	NPRD-2016 P1802-71	0.25	0.25	0.25	1.00	0.05		1.80	0.99999937
4.1.27	STATION, AIR CONDITIONING	PUMP DISCHARGE CONTROL VALVE	1	2.87E+06	0.35	2.87E+06	0.35	NPRD-2016 P3050 40	0.25	0.25	0.25	1.00	0.05		1.80	0.99999937
4.1.28	STATION, AIR CONDITIONING	CHECK VALVE	1	8.61E+06	0.12	8.61E+06	0.12	NPRD-2016 P1473-54	0.25	0.25	0.25	1.00	0.05		1.80	0.99999979
4.1.29	STATION, AIR CONDITIONING	GLOBE VALVE	1	3.03E+05	3.30	3.03E+05	3.30	NPRD-2016 P3181-22	0.25	0.25	0.25	1.00	0.05		1.80	0.99999407
4.1.30	STATION, AIR CONDITIONING	PRESSURE REDUCING VALVE	1	9.73E+04	10.28	9.73E+04	10.28	NPRD-2016 P2299 12	0.25	0.25	0.25	1.00	0.05		1.80	0.99998149
4.1.31	STATION, AIR CONDITIONING	PUMP	1	4.02E+07	0.02	4.02E+07	0.02	NPRD-2016 P2328-25	0.25	0.25	0.25	1.00	0.05		1.80	0.99999996
4.1.32	STATION, AIR CONDITIONING	PRESSURE RELIEF	1	2.87E+06	0.35	2.87E+06	0.35	NPRD-2016 P3178-30	0.25	0.25	0.25	1.00	0.05		1.80	0.99999937
4.1.33	STATION, AIR CONDITIONING	VALVE	1	4.55E+06	0.22	4.SSE+06	0.22	NPRD-2016 P3153-26	0.25	0.25	0.25	1.00	0.05		1.80	0.99999960
4.1.34	STATION, AIR CONDITIONING	PRESSURE GAUGE	1	3.33E+04	30.00	3.33E+04	30.00	NPRD-2016 P1543 22	0.25	0.25	0.25	1.00	0.05		1.80	0.99994600
4.1.35	STATION, AIR CONDITIONING	PRESSURE SENSOR	1	5.01E+05	2.00	5.01E+05	2.00	NPRD-2016 P2565-17	0.25	0.25	0.25	1.00	0.05		1.80	0.99999641
4.1.36	STATION, AIR CONDITIONING	THRUST BLOCK	1	2.30E+07	0.04	2.30E+07	0.04	NPRD-2016 P1302-32	0.25	0.25	0.25	1.00	0.05		1.80	0.99999992
4.1.37	STATION, AIR CONDITIONING	FIRE DAMPER	1	2.37E+06	0.42	2.37E+06	0.42	NPRD-2016 P790 32	0.25	0.25	0.25	4.00	0.05		4.80	0.99999797
4.1.38	STATION, AIR CONDITIONING	SMOKE DAMPER	1	2.37E+06	0.42	2.37E+06	0.42	NPRD-2016 P790-32	0.25	0.25	0.25	4.00	0.05		4.80	0.99999797
4.1.39	STATION, AIR CONDITIONING	BALANCING DAMPER	1	2.37E+06	0.42	2.37E+06	0.42	NPRD-2016 P790-32	0.25	0.25	0.25	4.00	0.05		4.80	0.99999797

Ref.	System	Description	QPU	MTBF (hrs)	FR λ	Total MTBF	λ x QTY	Data Source	Logistic	Access	Isolation	Remove & Replace	Alignment	Test	TOTAL	Availability
4.1.40	STATION, AIR CONDITIONING	BACKDRAFT DAMPER	1	2.37E+06	0.42	2.37E+06	0.42	NPRD-2016 P790-32	0.25	0.25	0.25	0.50	0.05		1.30	0.99999945
4.1.41	STATION, AIR CONDITIONING	PRESSURE SENSOR	1	5.01E+05	2.00	5.01E+05	2.00	NPRD-2016 P2565-17	0.25	0.25	0.25	0.50	0.05		1.30	0.99999741
4.1.42	STATION, AIR CONDITIONING	THERMOSTAT, BASEBOARD HEATER	1	5.75E+04	17.39	5.75E+04	17.39	NPRD-2016 P2983-25	0.25	0.25	0.25	0.50	0.05		1.30	0.99997740
4.1.43	STATION, AIR CONDITIONING	COMBINATION VALVE (SOV, CHECK, BALANCING)	1	2.90E+05	3.45	2.90E+05	3.45	NPRD-2016 P506-41	0.25	0.25	0.25	0.50	0.05		1.30	0.99999552
4.1.44	STATION, AIR CONDITIONING	SUPPLY AIR FAN	1	2.93E+05	3.42	2.93E+05	3.42	NPRD-2016 P992-19	0.25	0.25	0.25	1.00	0.05		1.80	0.99999385
4.1.45	STATION, AIR CONDITIONING	RETURN AIR FAN	1	2.93E+05	3.42	2.93E+05	3.42	NPRD-2016 P992-19	0.25	0.25	0.25	1.00	0.05		1.80	0.99999385
4.1.46	STATION, AIR CONDITIONING	EXHAUST AIR FAN	1	2.93E+05	3.42	2.93E+05	3.42	NPRD-2016 P992-19	0.25	0.25	0.25	1.00	0.05		1.80	0.99999385
4.1.47	STATION, AIR CONDITIONING	ELECTRIC ACTUATOR	1	4.70E+04	21.28	4.70E+04	21.28	NPRD-2016 P9-66	0.25	0.25	0.25	1.00	0.05		1.80	0.99996170
4.1.48	STATION, AIR CONDITIONING	ELECTRIC SOLENOID	1	3.24E+05	3.09	3.24E+05	3.09	NPRD-2016 P2671-27	0.25	0.25	0.25	0.50	0.05		1.30	0.99999599
4.1.49	STATION, AIR CONDITIONING	HEATING COIL	1	7.15E+04	13.99	7.15E+04	13.99	NPRD-2016 P1665-46	0.25	0.25	0.25	0.50	0.05		1.30	0.99998181
4.1.50	STATION, AIR CONDITIONING	COOLING COIL	1	7.50E+05	1.33	7.50E+05	1.33	NPRD-2016 P670-37	0.25	0.25	0.25	0.50	0.05		1.30	0.99999827
4.1.51	STATION, AIR CONDITIONING	AIR HANDLING UNIT(AHU)	2	5.87E+04	17.03	2.94E+04	34.06	NPRD-2016 P62-71	0.25	0.25	0.25	4.00	0.05		4.80	0.99983652
4.1.52	STATION, AIR CONDITIONING	AUDIO AND VISUAL	1	1.00E+08	0.01	1.00E+08	0.01	Engineering Judgement	0.25	0.25	0.25	1.00	0.05		1.80	0.99999998
4.1.53	STATION, AIR CONDITIONING	CONDENSER UNIT	6	1.96E+04	51.10	3.26E+03	306.58	NPRD-2016 P62-71	0.25	0.25	0.25	1.00	0.05		1.80	0.99944847
4.1.54	STATION, AIR CONDITIONING	DUCT HEATER	2	3.98E+05	2.51	1.99E+05	5.03	NPRD-2016 P1666-19	0.25	0.25	0.25	1.00	0.05		1.80	0.99999095
4.1.55	STATION, AIR CONDITIONING	FAN	6	4.96E+03	201.61	8.27E+02	1209.68	NPRD-2016 P994-44	0.25	0.25	0.25	1.00	0.05		1.80	0.99782731
4.1.56	STATION, AIR CONDITIONING	SUPPLY FAN	6	4.96E+03	201.61	8.27E+02	1209.68	NPRD-2016 P994-44	0.25	0.25	0.25	1.00	0.05		1.80	0.99782731
4.1.57	STATION, AIR CONDITIONING	HEAT RECOVERY VENTILATOR	1	1.84E+06	0.54	1.84E+06	0.54	NPRD-2016 P662-51	0.25	0.25	0.25	1.00	0.05		1.80	0.99999902
4.1.58	STATION, AIR CONDITIONING	BASEBOARD HEATER	34	5.42E+04	18.44	1.60E+03	626.90	NPRD-2016 P662-51	0.25	0.25	0.25	1.00	0.05		1.80	0.99887285
4.1.59	STATION, AIR CONDITIONING	FORCED-FLOW HEATER	3	6.15E+05	1.63	2.05E+05	4.88	NPRD-2016 P662-51	0.25	0.25	0.25	1.00	0.05		1.80	0.99999121
4.1.60	STATION, AIR CONDITIONING	HEAT TRACING CONTROL PANEL	4	1.31E+06	0.77	3.27E+05	3.06	NPRD-2016 P650-24	0.25	0.25	0.25	1.00	0.05		1.80	0.99999449
4.1.61	STATION, AIR CONDITIONING	UNIT HEATER	3	6.15E+05	1.63	2.05E+05	4.88	NPRD-2016 P662-51	0.25	0.25	0.25	1.00	0.05		1.80	0.99999121
4.1.62	STATION, AIR CONDITIONING	WALL HEATER	4	4.61E+05	2.17	1.15E+05	8.68	NPRD-2016 P662-51	0.25	0.25	0.25	1.00	0.05		1.80	0.99998438
4.1.63	STATION, AIR CONDITIONING	HUMIDIFIER	1	1.17E+05	8.52	1.17E+05	8.52	NPRD-2016 P62-71	0.25	0.25	0.25	1.00	0.05		1.80	0.99998467
4.2.1	STATION, LIGHTING	POWER TRANSFORMER	10	1.75E+07	0.06	1.75E+06	0.57	IEEE-493 table T10-4-337	0.25	0.25	0.25	8.00	0.05		8.80	0.99999498
4.2.2	STATION, LIGHTING	CIRCUIT BREAKER	10	6.75E+03	148.19	6.75E+02	1481.92	NPRD-2016 P511-38	0.25	0.25	0.25	1.00	0.05		1.80	0.99733964
4.2.3	STATION, LIGHTING	DRAW-OUT AIR CIRCUIT BREAKER	10	6.75E+03	148.19	6.75E+02	1481.92	NPRD-2016 P511-38	0.25	0.25	0.25	1.00	0.05		1.80	0.99733964
4.2.4	STATION, LIGHTING	UNFUSED VOLTAGE DISCONNECT SWITCH	10	4.38E+07	0.02	4.38E+06	0.23	IEEE-493 table T10-4-219	0.25	0.25	0.25	1.00	0.05		1.80	0.99999959
4.2.5	STATION, LIGHTING	UNFUSED HIGH VOLTAGE DISCONNECT SWITCH	10	4.38E+07	0.02	4.38E+06	0.23	IEEE-493 table T10-4-219	0.25	0.25	0.25	1.00	0.05		1.80	0.99999959
4.2.6	STATION, LIGHTING	FUSE	10	4.38E+07	0.02	4.38E+06	0.23	IEEE-493 table T10-4-219	0.25	0.25	0.25	1.00	0.05		1.80	0.99999959
4.2.7	STATION, LIGHTING	FUSE DISCONNECT SWITCH	10	4.38E+07	0.02	4.38E+06	0.23	IEEE-493 table T10-4-219	0.25	0.25	0.25	1.00	0.05		1.80	0.99999959
4.2.8	STATION, LIGHTING	FUSE HIGH VOLTAGE SWITCH	10	4.38E+07	0.02	4.38E+06	0.23	IEEE-493 table T10-4-219	0.25	0.25	0.25	1.00	0.05		1.80	0.99999959
4.2.9	STATION, LIGHTING	CURRENT LIMITING FUSES	10	6.75E+03	148.19	6.75E+02	1481.92	NPRD-2016 P511-38	0.25	0.25	0.25	1.00	0.05		1.80	0.99733964
4.2.10	STATION, LIGHTING	CIRCUIT BREAKER, MEDIUM VOLTAGE	10	6.75E+03	148.19	6.75E+02	1481.92	NPRD-2016 P511-38	0.25	0.25	0.25	1.00	0.05		1.80	0.99733964
4.2.11	STATION, LIGHTING	CIRCUIT BREAKER, MEDIUM VOLTAGE	10	6.75E+03	148.19	6.75E+02	1481.92	NPRD-2016 P511-38	0.25	0.25	0.25	1.00	0.05		1.80	0.99733964
4.2.12	STATION, LIGHTING	AUTOMATIC TRANSFER SWITCH, MANUAL BYPASS	10	4.38E+07	0.02	4.38E+06	0.23	IEEE-493 table T10-4-219	0.25	0.25	0.25	1.00	0.05		1.80	0.99999959
4.2.13	STATION, LIGHTING	AUTOMATIC TRANSFER SWITCH, NO BYPASS	10	4.38E+07	0.02	4.38E+06	0.23	IEEE-493 table T10-4-219	0.25	0.25	0.25	1.00	0.05		1.80	0.99999959
4.2.14	STATION, LIGHTING	AUTOMATIC TRANSFER SWITCH	10	4.38E+07	0.02	4.38E+06	0.23	IEEE-493 table T10 4 219	0.25	0.25	0.25	1.00	0.05		1.80	0.99999959
4.2.15	STATION, LIGHTING	SWITCH, HAND OFF AUTO (HOA)	10	3.65E+04	27.40	3.65E+03	273.97	NPRD-2016 P2909-45	0.25	0.25	0.25	1.00	0.05		1.80	0.99950709
4.2.16	STATION, LIGHTING	UPS	10	4.28E+03	233.64	4.28E+02	2336.45	NPRD-2016 P2293-68	0.25	0.25	0.25	4.00	0.05		4.80	0.98890943
4.2.17	STATION, LIGHTING	POTENTIAL TRANSFORMER	10	1.75E+07	0.06	1.75E+06	0.57	IEEE-493 table T10-4-337	0.25	0.25	0.25	8.00	0.05		8.80	0.99999498
4.2.18	STATION, LIGHTING	CURRENT TRANSFORMER	10	1.75E+07	0.06	1.75E+06	0.57	IEEE-493 table T10-4-337	0.25	0.25	0.25	8.00	0.05		8.80	0.99999498
4.2.19	STATION, LIGHTING	CURRENT METER C/W TRANSFORMER	10	2.87E+05	3.48	2.87E+04	34.83	NPRD-2016 P3243-14	0.25	0.25	0.25	1.00	0.05		1.80	0.99993731
4.2.20	STATION, LIGHTING	METER	10	1.79E+04	55.85	1.79E+03	558.53	NPRD-2016 P1983-52	0.25	0.25	0.25	1.00	0.05		1.80	0.99899565
4.2.21	STATION, LIGHTING	PILOT LIGHT	10	5.74E+05	1.74	5.74E+04	17.41	NPRD-2016 P647 71	0.25	0.25	0.25	1.00	0.05		1.80	0.99996866
4.2.22	STATION, LIGHTING	MOTOR OVERLOAD	10	2.37E+05	4.23	2.37E+04	42.28	NPRD-2016 P2317-58	0.25	0.25	0.25	0.50	0.05		1.30	0.99994504
4.2.23	STATION, LIGHTING	CONTROL RELAY	10	3.21E+04	31.19	3.21E+03	311.94	NPRD-2016 P2427-81	0.25	0.25	0.25	0.50	0.05		1.30	0.99959464
4.2.24	STATION, LIGHTING	START PUSH BUTTON	10	9.32E+04	10.72	9.32E+03	107.24	NPRD-2016 P2349-43	0.25	0.25	0.25	0.50	0.05		1.30	0.99986061
4.2.25	STATION, LIGHTING	STOP PUSH BUTTON	10	9.32E+04	10.72	9.32E+03	107.24	NPRD-2016 P2349-43	0.25	0.25	0.25	0.50	0.05		1.30	0.99986061

Ref.	System	Description	QPU	MTBF (hrs)	FR λ	Total MTBF	λ x QTY	Data Source	Logistic	Access	Isolation	Remove & Replace	Alignment	Test	TOTAL	Availability
4.2.26	STATION, LIGHTING	GROUND FAULT RELAY C/W CONTROL TRANSFORMER	10	3.21E+04	31.19	3.21E+03	311.94	NPRD-2016 P2427-81	0.25	0.25	0.25	0.50	0.05		1.30	0.99959464
4.2.27	STATION, LIGHTING	GROUND FAULT RELAY	10	3.21E+04	31.19	3.21E+03	311.94	NPRD-2016 P2427-81	0.25	0.25	0.25	0.50	0.05		1.30	0.99959464
4.2.28	STATION, LIGHTING	VARIABLE FREQUENCY DRIVE	10	4.97E+05	2.01	4.97E+04	20.14	NPRD-2016 P2011-20	0.25	0.25	0.25	0.50	0.05		1.30	0.99997382
4.2.29	STATION, LIGHTING	BATTERY	10	3.68E+03	271.67	3.68E+02	2716.65	NPRD-2016 P173-17	0.25	0.25	0.25	2.00	0.05		2.80	0.99245080
4.2.30	STATION, LIGHTING	GENERATOR	10	1.12E+04	89.29	1.12E+03	892.86	NPRD-2016 P1569-20	0.25	0.25	0.25	2.00	0.05		2.80	0.99750623
4.2.31	STATION, LIGHTING	MOTOR / FAN	10	4.98E+04	20.08	4.98E+03	200.77	NPRD-2016 P995-36	0.25	0.25	0.25	2.00	0.05		2.80	0.99943816
4.2.32	STATION, LIGHTING	PANEL BOARD	10	4.28E+03	233.64	4.28E+02	2336.45	NPRD-2016 P243-70	0.25	0.25	0.25	1.00	0.05		1.80	0.99581201
4.2.33	STATION, LIGHTING	SURGE PROTECTION DEVICE	10	4.28E+03	233.64	4.28E+02	2336.45	NPRD-2016 P243-70	0.25	0.25	0.25	1.00	0.05		1.80	0.99581201
4.2.34	STATION, LIGHTING	PANEL BOARD AND BREAKER	10	4.28E+03	233.64	4.28E+02	2336.45	NPRD-2016 P243-70	0.25	0.25	0.25	1.00	0.05		1.80	0.99581201
4.2.35	STATION, LIGHTING	PANEL BOARD AND FUSED SWITCH	10	3.65E+04	27.40	3.65E+03	273.97	NPRD-2016 P2909-45	0.25	0.25	0.25	1.00	0.05		1.80	0.99950709
4.2.36	STATION, LIGHTING	SURGE PROTECTION DEVICE	10	2.37E+05	4.23	2.37E+04	42.28	NPRD-2016 P2874-43	0.25	0.25	0.25	1.00	0.05		1.80	0.99992390
4.2.37	STATION, LIGHTING	ON-OFF TOGGLE SWITCH	10	3.65E+04	27.40	3.65E+03	273.97	NPRD-2016 P2909-45	0.25	0.25	0.25	0.50	0.05		1.30	0.99964396
4.2.38	STATION, LIGHTING	FLUORESCENT LIGHTING, SURFACE MOUNTED	10	3.03E+04	32.95	3.03E+03	329.50	NPRD-2016 P1858-36	0.25	0.25	0.25	0.50	0.05		1.30	0.99957183
4.2.39	STATION, LIGHTING	FLUORESCENT LIGHTING, SURFACE MOUNTED	10	3.03E+04	32.95	3.03E+03	329.50	NPRD-2016 P1858-36	0.25	0.25	0.25	0.50	0.05		1.30	0.99957183
4.2.40	STATION, LIGHTING	FLUORESCENT LIGHTING, RECESSED	10	3.03E+04	32.95	3.03E+03	329.50	NPRD-2016 P1858-36	0.25	0.25	0.25	0.50	0.05		1.30	0.99957183
4.2.41	STATION, LIGHTING	FLUORESCENT LIGHTING, RECESSED	10	3.03E+04	32.95	3.03E+03	329.50	NPRD-2016 P1858-36	0.25	0.25	0.25	0.50	0.05		1.30	0.99957183
4.2.42	STATION, LIGHTING	FLUORESCENT LIGHTING, WALL MOUNTED	10	3.03E+04	32.95	3.03E+03	329.50	NPRD-2016 P1858-36	0.25	0.25	0.25	0.50	0.05		1.30	0.99957183
4.2.43	STATION, LIGHTING	FLUORESCENT LIGHTING, WALL MOUNTED	10	3.03E+04	32.95	3.03E+03	329.50	NPRD-2016 P1858-36	0.25	0.25	0.25	0.50	0.05		1.30	0.99957183
4.2.44	STATION, LIGHTING	FLUORESCENT LIGHTING, SUSPENDED	10	3.03E+04	32.95	3.03E+03	329.50	NPRD-2016 P1858-36	0.25	0.25	0.25	0.50	0.05		1.30	0.99957183
4.2.45	STATION, LIGHTING	FLUORESCENT LIGHTING, SUSPENDED	10	3.03E+04	32.95	3.03E+03	329.50	NPRD-2016 P1858-36	0.25	0.25	0.25	0.50	0.05		1.30	0.99957183
4.2.46	STATION, LIGHTING	COMPACT FLUORESCENT DOWNLIGHT	10	3.73E+06	0.27	3.73E+05	2.68	NPRD-2016 P1859-24	0.25	0.25	0.25	0.50	0.05		1.30	0.99999652
4.2.47	STATION, LIGHTING	COMPACT FLUORESCENT LIGHT, WALL MOUNTED	10	3.73E+06	0.27	3.73E+05	2.68	NPRD-2016 P1859-24	0.25	0.25	0.25	0.50	0.05		1.30	0.99999652
4.2.48	STATION, LIGHTING	FLUORESCENT LUMINAIRE, RECESSED	10	3.03E+04	32.95	3.03E+03	329.50	NPRD-2016 P1858-36	0.25	0.25	0.25	0.50	0.05		1.30	0.99957183
4.2.49	STATION, LIGHTING	STRIP FLUORESCENT LUMINAIRE	10	3.03E+04	32.95	3.03E+03	329.50	NPRD-2016 P1858-36	0.25	0.25	0.25	0.50	0.05		1.30	0.99957183
4.2.50	STATION, LIGHTING	FLUORESCENT LUMINAIRE, SURFACE MOUNTED	10	3.03E+04	32.95	3.03E+03	329.50	NPRD-2016 P1858-36	0.25	0.25	0.25	0.50	0.05		1.30	0.99957183
4.2.51	STATION, LIGHTING	FLUORESCENT LUMINAIRE, SURFACE MOUNTED	10	3.03E+04	32.95	3.03E+03	329.50	NPRD-2016 P1858-36	0.25	0.25	0.25	0.50	0.05		1.30	0.99957183
4.2.52	STATION, LIGHTING	FLUORESCENT LUMINAIRE, RECESSED	10	3.03E+04	32.95	3.03E+03	329.50	NPRD-2016 P1858-36	0.25	0.25	0.25	0.50	0.05		1.30	0.99957183
4.2.53	STATION, LIGHTING	FLUORESCENT LUMINAIRE, RECESSED	10	3.03E+04	32.95	3.03E+03	329.50	NPRD-2016 P1858-36	0.25	0.25	0.25	0.50	0.05		1.30	0.99957183
4.2.54	STATION, LIGHTING	FLUORESCENT LUMINAIRE, WALL MOUNTED	10	3.03E+04	32.95	3.03E+03	329.50	NPRD-2016 P1858-36	0.25	0.25	0.25	0.50	0.05		1.30	0.99957183
4.2.55	STATION, LIGHTING	FLUORESCENT LUMINAIRE, WALL MOUNTED	10	3.03E+04	32.95	3.03E+03	329.50	NPRD-2016 P1858-36	0.25	0.25	0.25	0.50	0.05		1.30	0.99957183
4.2.56	STATION, LIGHTING	FLUORESCENT LUMINAIRE, SUSPENDED	10	3.03E+04	32.95	3.03E+03	329.50	NPRD-2016 P1858-36	0.25	0.25	0.25	0.50	0.05		1.30	0.99957183
4.2.57	STATION, LIGHTING	FLUORESCENT LUMINAIRE, SUSPENDED	10	3.03E+04	32.95	3.03E+03	329.50	NPRD-2016 P1858-36	0.25	0.25	0.25	0.50	0.05		1.30	0.99957183
4.2.58	STATION, LIGHTING	COMPACT FLOURESCENT, RECESSED	10	3.73E+06	0.27	3.73E+05	2.68	NPRD-2016 P1859-24	0.25	0.25	0.25	0.50	0.05		1.30	0.99999652
4.2.59	STATION, LIGHTING	COMPACT FLOURESCENT, WALL MOUNTED	10	3.73E+06	0.27	3.73E+05	2.68	NPRD-2016 P1859-24	0.25	0.25	0.25	0.50	0.05		1.30	0.99999652
4.2.60	STATION, LIGHTING	FLUORESCENT LUMINAIRE, RECESSED	10	3.03E+04	32.95	3.03E+03	329.50	NPRD-2016 P1858-36	0.25	0.25	0.25	0.50	0.05		1.30	0.99957183
4.2.61	STATION, LIGHTING	STRIP LUMINAIRE	10	3.03E+04	32.95	3.03E+03	329.50	NPRD-2016 P1858-36	0.25	0.25	0.25	0.50	0.05		1.30	0.99957183
4.2.62	STATION, LIGHTING	EXTERIOR LUMINAIRE	10	3.03E+04	32.95	3.03E+03	329.50	NPRD-2016 P1858-36	0.25	0.25	0.25	0.50	0.05		1.30	0.99957183
4.2.63	STATION, LIGHTING	LUMINAIRE C/W MOUNTING	10	3.03E+04	32.95	3.03E+03	329.50	NPRD-2016 P1858-36	0.25	0.25	0.25	0.50	0.05		1.30	0.99957183
4.2.64	STATION, LIGHTING	LUMINAIRE C/W MOUNTING	10	3.03E+04	32.95	3.03E+03	329.50	NPRD-2016 P1858-36	0.25	0.25	0.25	0.50	0.05		1.30	0.99957183
4.2.65	STATION, LIGHTING	LUMINAIRE C/W MOUNTING POLE	10	3.03E+04	32.95	3.03E+03	329.50	NPRD-2016 P1858-36	0.25	0.25	0.25	0.50	0.05		1.30	0.99957183
4.2.66	STATION, LIGHTING	TIME SWITCH	10	2.14E+03	467.29	2.14E+02	4672.90	NPRD-2016 P2909-35	0.25	0.25	0.25	0.50	0.05		1.30	0.99396191
4.2.67	STATION, LIGHTING	PHOTOCELL	10	2.62E+05	3.82	2.62E+04	38.17	NPRD-2016 P2193-13	0.25	0.25	0.25	0.50	0.05		1.30	0.99995038
4.2.68	STATION, LIGHTING	OCCUPANCY SENSOR - CEILING MOUNTED	10	3.73E+06	0.27	3.73E+05	2.68	NPRD-2016 P1859-24	0.25	0.25	0.25	0.50	0.05		1.30	0.99999652
4.2.69	STATION, LIGHTING	OCCUPANCY SENSOR - WALL MOUNTED	10	3.73E+06	0.27	3.73E+05	2.68	NPRD-2016 P1859-24	0.25	0.25	0.05	0.50	0.05		1.10	0.99999705
4.3.1	STATION, PUMPS (SUMPS)	STANDPIPE BOOSTER PUMP	1	3.33E+04	30.00	3.33E+04	30.00	NPRD-2016 P2402-28	0.25	0.25	0.05	0.50	0.05		1.10	0.99996700
4.3.2	STATION, PUMPS (SUMPS)	SUMP PUMP	16	4.18E+04	23.92	2.61E+03	382.69	NPRD-2016 P2340-48	0.25	0.25	0.05	0.50	0.05		1.10	0.99957922
4.3.3	STATION, PUMPS (SUMPS)	PRESSURE REDUCING VALVE	1	6.69E+05	1.49	6.69E+05	1.49	NPRD-2016 P2408-51	0.25	0.25	0.25	0.50	0.05		1.30	0.99999806
4.3.4	STATION, PUMPS (SUMPS)	PUMP	1	4.02E+07	0.02	4.02E+07	0.02	NPRD-2016 P2328-25	0.25	0.25	0.00	0.50	0.05		1.05	0.99999997
4.3.5	STATION, PUMPS (SUMPS)	SOLENOID VALVE	1	1.44E+06	0.70	1.44E+06	0.70	NPRD-2016 P2672-77	0.25	0.25	0.05	0.50	0.05		1.10	0.99999923

Ref.	System	Description	QPU	MTBF (hrs)	FR A	Total MTBF	A x QTY	Data Source	Logistic	Access	Isolation	Remove & Replace	Alignment	Test	TOTAL	Availability
4.3.6	STATION, PUMPS (SUMPS)	BACK WATER VALVE (DRAINAGE)	1	8.61E+06	0.12	8.61E+06	0.12	NPRD-2016 P1473-54	0.25	0.25	0.05	0.50	0.05		1.10	0.99999987
4.3.7	STATION, PUMPS (SUMPS)	WATER METER C/W BY-PASS	1	6.94E+07	0.01	6.94E+07	0.01	NPRD-2016 P1990-76	0.25	0.25	0.05	0.50	0.05		1.10	0.99999998
4.3.8	STATION, PUMPS (SUMPS)	GAS METER	1	1.79E+05	5.59	1.79E+05	5.59	NPRD-2016 P1983-52	0.25	0.25	0.00	0.50	0.05		1.05	0.99999414
4.3.9	STATION, PUMPS (SUMPS)	DRINKING FOUNTAIN	1	4.81E+05	2.08	4.81E+05	2.08	NPRD-2016 P386-54	0.25	0.25	0.00	0.50	0.05		1.05	0.99999782
4.3.10	STATION, PUMPS (SUMPS)	SHOWER SUPPLY TRIM	1	2.37E+06	0.42	2.37E+06	0.42	NPRD-2016 P3204-68	0.25	0.25	0.00	0.50	0.05		1.05	0.99999956
4.4.1	STATION, UTILITIES	TRAP PRIMER MANIFOLD SCHEDULE	20	2.61E+05	3.83	1.31E+04	76.56	NPRD-2016 P650-24	0.25	0.25	0.05	0.50	0.05		1.10	0.99991579
4.4.2	STATION, UTILITIES	VAV (VARIABLE AIR VOLUME)	32	2.07E+04	48.32	6.47E+02	1546.34	NPRD-2016 P1661-78	0.25	0.25	0.05	0.50	0.05		1.10	0.99830191
4.4.3	STATION, UTILITIES	DOMESTIC HOT WATER TANK	4	4.61E+05	2.17	1.15E+05	8.68	NPRD-2016 P662-51	0.25	0.25	0.05	0.50	0.05		1.10	0.99999046
4.5.1	STATION, FIRE PROTECTION	ALARM GONG	5	4.44E+04	22.50	8.89E+03	112.50	NPRD-2016 P96-54	0.25	0.25	0.05	0.50	0.05		1.10	0.99987626
4.5.2	STATION, FIRE PROTECTION	FLOW SWITCH	5	2.02E+05	4.94	4.05E+04	24.72	NPRD-2016 P2884-57	0.25	0.25	0.05	0.50	0.05		1.10	0.99997281
4.5.3	STATION, FIRE PROTECTION	PRESSURE SWITCH	5	1.04E+04	95.73	2.09E+03	478.65	NPRD-2016 P2892-23	0.25	0.25	0.05	0.50	0.05		1.10	0.99947376
4.5.4	STATION, FIRE PROTECTION	CHECK VALVE	5	1.72E+06	0.58	3.45E+05	2.90	NPRD-2016 P1473-54	0.25	0.25	0.05	0.50	0.05		1.10	0.99999681
4.5.5	STATION, FIRE PROTECTION	PUMP	5	8.03E+06	0.12	1.61E+06	0.62	NPRD-2016 P2328-25	0.25	0.25	0.05	0.50	0.05		1.10	0.99999932
4.5.6	STATION, FIRE PROTECTION	AIR COMPRESSOR	5	1.88E+04	53.23	3.76E+03	266.16	NPRD-2016 P61-28	0.25	0.25	0.05	0.50	0.05		1.10	0.99970731
4.5.7	STATION, FIRE PROTECTION	PRESSURE SWITCH	5	1.88E+04	53.23	3.76E+03	266.16	NPRD-2016 P61-28	0.25	0.25	0.05	0.50	0.05		1.10	0.99970731
4.5.8	STATION, FIRE PROTECTION	FLOW SWITCH	5	2.02E+05	4.94	4.05E+04	24.72	NPRD-2016 P2884-57	0.25	0.25	0.05	0.50	0.05		1.10	0.99997281
4.5.9	STATION, FIRE PROTECTION	EXCESS PRESSURE PUMP	5	8.03E+06	0.12	1.61E+06	0.62	NPRD-2016 P2328-25	0.25	0.25	0.05	0.50	0.05		1.10	0.99999932
4.5.10	STATION, FIRE PROTECTION	FIRE ALARM MANUAL PULL	5	1.67E+05	5.98	3.34E+04	29.91	NPRD-2016 P2923-66	0.25	0.25	0.05	0.50	0.05		1.10	0.99996710
4.5.11	STATION, FIRE PROTECTION	AUTOMATIC HEAT DETECTOR	5	9.32E+04	10.72	1.86E+04	53.62	NPRD-2016 P804-47	0.25	0.25	0.05	0.50	0.05		1.10	0.99994102
4.5.12	STATION, FIRE PROTECTION	CONVENTIONAL HEAT DETECTOR	5	9.32E+04	10.72	1.86E+04	53.62	NPRD-2016 P804 47	0.25	0.25	0.05	0.50	0.05		1.10	0.99994102
4.5.13	STATION, FIRE PROTECTION	AUTOMATIC HEAT DETECTOR	5	9.32E+04	10.72	1.86E+04	53.62	NPRD-2016 P804-47	0.25	0.25	0.05	0.50	0.05		1.10	0.99994102
4.5.14	STATION, FIRE PROTECTION	CONVENTIONAL HEAT DETECTOR	5	9.32E+04	10.72	1.86E+04	53.62	NPRD-2016 P804-47	0.25	0.25	0.05	0.50	0.05		1.10	0.99994102
4.5.15	STATION, FIRE PROTECTION	AUTOMATIC HEAT DETECTOR	5	9.32E+04	10.72	1.86E+04	53.62	NPRD-2016 P804-47	0.25	0.25	0.05	0.50	0.05		1.10	0.99994102
4.5.16	STATION, FIRE PROTECTION	AUTOMATIC HEAT DETECTOR	5	9.32E+04	10.72	1.86E+04	53.62	NPRD-2016 P804-47	0.25	0.25	0.05	0.50	0.05		1.10	0.99994102
4.5.17	STATION, FIRE PROTECTION	SMOKE DETECTOR	5	9.32E+04	10.72	1.86E+04	53.62	NPRD-2016 P804-47	0.25	0.25	0.00	0.50	0.05		1.05	0.99994370
4.5.18	STATION, FIRE PROTECTION	SMOKE DETECTOR	5	9.32E+04	10.72	1.86E+04	53.62	NPRD-2016 P804-47	0.25	0.25	0.00	0.50	0.05		1.05	0.99994370
4.5.19	STATION, FIRE PROTECTION	SMOKE DETECTOR	5	9.32E+04	10.72	1.86E+04	53.62	NPRD-2016 P804 47	0.25	0.25	0.00	0.50	0.05		1.05	0.99994370
4.5.20	STATION, FIRE PROTECTION	FLAME DETECTOR	5	9.32E+04	10.72	1.86E+04	53.62	NPRD-2016 P804-47	0.25	0.25	0.00	0.50	0.05		1.05	0.99994370
4.5.21	STATION, FIRE PROTECTION	SMOKE ALARM	5	4.44E+04	22.50	8.89E+03	112.50	NPRD-2016 P96-54	0.25	0.25	0.00	0.50	0.05		1.05	0.99988189
4.5.22	STATION, FIRE PROTECTION	FIREFIGHTERS TELEPHONE	5	3.70E+04	26.99	7.41E+03	134.97	NPRD-2016 P2960-23	0.25	0.25	0.00	0.50	0.05		1.05	0.99985830
4.5.23	STATION, FIRE PROTECTION	FIRE ALARM BELL	5	1.67E+05	5.98	3.34E+04	29.91	NPRD-2016 P2923-66	0.25	0.25	0.00	0.50	0.05		1.05	0.99996859
4.5.24	STATION, FIRE PROTECTION	FIRE ALARM HORN	5	1.67E+05	5.98	3.34E+04	29.91	NPRD-2016 P2923-66	0.25	0.25	0.00	0.50	0.05		1.05	0.99996859
4.5.25	STATION, FIRE PROTECTION	FIRE ALARM STROBE AND LIGHT	5	1.67E+05	5.98	3.34E+04	29.91	NPRD-2016 P2923-66	0.25	0.25	0.00	0.50	0.05		1.05	0.99996859
4.5.26	STATION, FIRE PROTECTION	FIRE ALARM STROBE AND LIGHT	5	1.67E+05	5.98	3.34E+04	29.91	NPRD 2016 P2923-66	0.25	0.25	0.00	0.50	0.05		1.05	0.99996859
4.5.27	STATION, FIRE PROTECTION	FIRE ALARM STROBE AND LIGHT	5	6.41E+04	15.60	1.28E+04	77.98	NPRD-2016 P2427-81	0.25	0.25	0.00	0.50	0.05		1.05	0.99991812
4.5.28	STATION, FIRE PROTECTION	FIRE ALARM GONG	5	6.41E+04	15.60	1.28E+04	77.98	NPRD-2016 P2427-81	0.25	0.25	0.00	0.50	0.05		1.05	0.99991812
4.5.29	STATION, FIRE PROTECTION	FIRE ALARM CHIME	5	6.41E+04	15.60	1.28E+04	77.98	NPRD-2016 P2427-81	0.25	0.25	0.00	0.50	0.05		1.05	0.99991812
4.5.30	STATION, FIRE PROTECTION	LED INDICATOR FOR HEAT DETECTOR	5	9.32E+04	10.72	1.86E+04	53.62	NPRD-2016 P804 47	0.25	0.25	0.00	0.50	0.05		1.05	0.99994370
4.5.31	STATION, FIRE PROTECTION	FIRE ALARM REMOTE INDICATOR LIGHT, SMOKE DETECTOR	5	9.32E+04	10.72	1.86E+04	53.62	NPRD-2016 P804-47	0.25	0.25	0.00	0.50	0.05		1.05	0.99994370
4.5.32	STATION, FIRE PROTECTION	FIRE ALARM SMOKE CONTROL DAMPER	5	6.41E+04	15.60	1.28E+04	77.98	NPRD-2016 P2427-81	0.25	0.25	0.00	0.50	0.05		1.05	0.99991812
4.5.33	STATION, FIRE PROTECTION	INTERFACE CONTROL RELAY	5	6.41E+04	15.60	1.28E+04	77.98	NPRD-2016 P2427-81	0.25	0.25	0.00	0.50	0.05		1.05	0.99991812
4.5.34	STATION, FIRE PROTECTION	FIRE ALARM INTERFACE MONITOR	5	6.41E+04	15.60	1.28E+04	77.98	NPRD-2016 P2427-81	0.25	0.25	0.00	0.50	0.05		1.05	0.99991812
4.5.35	STATION, FIRE PROTECTION	FIRE ALARM ISOLATE MODULE	5	6.41E+04	15.60	1.28E+04	77.98	NPRD-2016 P2427-81	0.25	0.25	0.00	0.50	0.05		1.05	0.99991812
4.5.36	STATION, FIRE PROTECTION	SPRINKLER FLOW ALARM SWITCH	5	1.67E+05	5.98	3.34E+04	29.91	NPRD-2016 P2923-66	0.25	0.25	0.05	0.50	0.05		1.10	0.99996710
4.5.37	STATION, FIRE PROTECTION	SPRINKLER FLOW SWITCH	5	1.67E+05	5.98	3.34E+04	29.91	NPRD-2016 P2923-66	0.25	0.25	0.05	0.50	0.05		1.10	0.99996710
4.5.38	STATION, FIRE PROTECTION	SPRINKLER TAMPER SWITCH	5	1.67E+05	5.98	3.34E+04	29.91	NPRD-2016 P2923-66	0.25	0.25	0.05	0.50	0.05		1.10	0.99996710
4.5.39	STATION, FIRE PROTECTION	SPRINKLER LOW PRESSURE SWITCH	5	1.67E+05	5.98	3.34E+04	29.91	NPRD-2016 P2923-66	0.25	0.25	0.05	0.50	0.05		1.10	0.99996710
4.6.1	STATION, POWER	BUZZER	1	3.03E+05	3.30	3.03E+05	3.30	NPRD-2016 P408-19	0.25	0.25	0.00	0.50	0.05		1.05	0.99999654
4.6.2	STATION, POWER	SNOW DETECTOR	1	4.66E+05	2.14	4.66E+05	2.14	NPRD-2016 P804-47	0.25	0.25	0.00	0.50	0.05		1.05	0.99999775

Ref.	System	Description	QPU	MTBF (hrs)	FR A	Total MTBF	A x QTY	Data Source	Logistic	Access	Isolation	Remove & Replace	Alignment	Test	TOTAL	Availability
4.6.3	STATION, POWER	MOTOR	1	4.98E+05	2.01	4.98E+05	2.01	NPRD-2016 P995-36	0.25	0.25	0.05	0.50	0.05		1.10	0.99999779
4.6.4	STATION, POWER	DISCONNECT SWITCH UNFUSED	1	6.69E+05	1.49	6.69E+05	1.49	NPRD-2016 P828-56	0.25	0.25	0.05	0.50	0.05		1.10	0.99999836
4.6.5	STATION, POWER	DISCONNECT SWITCH UNFUSED	1	6.69E+05	1.49	6.69E+05	1.49	NPRD-2016 P828-56	0.25	0.25	0.05	0.50	0.05		1.10	0.99999836
4.6.6	STATION, POWER	MOTOR STARTER- MAGNETIC	1	4.72E+07	0.02	4.72E+07	0.02	NPRD-2016 P2020-37	0.25	0.25	0.05	0.50	0.05		1.10	0.99999998
4.6.7	STATION, POWER	MAGNETIC STARTER & DISCONNECT SWITCH	1	6.69E+05	1.49	6.69E+05	1.49	NPRD-2016 P828-56	0.25	0.25	0.05	0.50	0.05		1.10	0.99999836
4.6.8	STATION, POWER	MOTOR C/W DISCONNECT SWITCH	1	4.97E+06	0.20	4.97E+06	0.20	NPRD-2016 P2011-20	0.25	0.25	0.05	0.50	0.05		1.10	0.99999978
4.6.9	STATION, POWER	MOTOR C/W STARTER	1	4.72E+07	0.02	4.72E+07	0.02	NPRD-2016 P2020-37	0.25	0.25	0.05	0.50	0.05		1.10	0.99999998
4.6.10	STATION, POWER	MOTOR C/W STARTER AND DISCONNECT SWITCH	1	4.97E+06	0.20	4.97E+06	0.20	NPRD-2016 P2011-20	0.25	0.25	0.05	0.50	0.05		1.10	0.99999978
4.6.11	STATION, POWER	ELECTRIC BASEBOARD HEATER	1	5.75E+04	17.39	5.75E+04	17.39	NPRD-2016 P2983-25	0.25	0.25	0.00	0.50	0.05		1.05	0.99998175
4.6.12	STATION, POWER	THERMOSTAT	1	3.32E+04	30.11	3.32E+04	30.11	NPRD-2016 P2983-19	0.25	0.25	0.00	0.50	0.05		1.05	0.99996839
4.6.13	STATION, POWER	VARIABLE FREQUENCY DRIVE	1	4.97E+06	0.20	4.97E+06	0.20	NPRD-2016 P2011-20	0.25	0.25	0.05	0.50	0.05		1.10	0.99999978
4.6.14	STATION, POWER	TIME DELAY RELAY	1	3.21E+05	3.12	3.21E+05	3.12	NPRD-2016 P2427-81	0.25	0.25	0.05	0.50	0.05		1.10	0.99999657
4.6.15	STATION, POWER	CONTROL RELAY	1	3.21E+05	3.12	3.21E+05	3.12	NPRD-2016 P2427-81	0.25	0.25	0.05	0.50	0.05		1.10	0.99999657
4.6.16	STATION, POWER	HAND DRYER OR HAIR DRYER	1	3.75E+05	2.66	3.75E+05	2.66	NPRD-2016 P62-27	0.25	0.25	0.00	0.50	0.05		1.05	0.99999720
4.6.17	STATION, POWER	UNIT HEATER PROVIDED	1	5.75E+04	17.39	5.75E+04	17.39	NPRD-2016 P2983-25	0.25	0.25	0.00	1.00	0.05		1.55	0.99997305
4.6.18	STATION, POWER	ELECTRIC UNIT HEATER	1	5.75E+04	17.39	5.75E+04	17.39	NPRD-2016 P2983-25	0.25	0.25	0.00	1.00	0.05		1.55	0.99997305
4.6.19	STATION, POWER	FORCE FLOW HEATER	1	5.75E+04	17.39	5.75E+04	17.39	NPRD-2016 P2983-25	0.25	0.25	0.00	1.00	0.05		1.55	0.99997305
4.6.20	STATION, POWER	ELECTRIC FORCE FLOW HEATER	1	5.75E+04	17.39	5.75E+04	17.39	NPRD-2016 P2983-25	0.25	0.25	0.00	1.00	0.05		1.55	0.99997305
4.6.21	STATION, POWER	MOTOR STARTER PANEL	1	4.72E+07	0.02	4.72E+07	0.02	NPRD-2016 P2020-37	0.25	0.25	0.00	1.00	0.05		1.55	0.99999997
4.7.1	STATION, COMMUNICATIONS	PTZ CAMERA (PAN-TILT-ZOOM)	1	1.14E+06	0.88	1.14E+06	0.88	NPRD-2016 P2017 58	0.25	0.25	0.00	1.00	0.05		1.55	0.99999864
4.7.2	STATION, COMMUNICATIONS	FIXED CAMERA	52	2.19E+04	45.66	4.21E+02	2374.43	NPRD-2016 P2017-58	0.25	0.25	0.00	1.00	0.05		1.55	0.99633313
4.7.3	STATION, COMMUNICATIONS	ELEVATOR HAND FREE INTERCOM	10	4.04E+03	247.65	4.04E+02	2476.47	NPRD-2016 P1826-44	0.25	0.25	0.00	1.00	0.05		1.55	0.99617614
4.7.4	STATION, COMMUNICATIONS	EMERGENCY TELEPHONE	10	1.85E+04	53.99	1.85E+03	539.90	NPRD-2016 P2960-23	0.25	0.25	0.00	1.00	0.05		1.55	0.99916386
4.7.5	STATION, COMMUNICATIONS	STAFF TELEPHONE	10	1.85E+04	53.99	1.85E+03	539.90	NPRD-2016 P2960-23	0.25	0.25	0.00	1.00	0.05		1.55	0.99916386
4.7.6	STATION, COMMUNICATIONS	MAINTENANCE TELEPHONE	10	1.85E+04	53.99	1.85E+03	539.90	NPRD-2016 P2960-23	0.25	0.25	0.00	1.00	0.05		1.55	0.99916386
4.7.7	STATION, COMMUNICATIONS	PHONE, PUBLIC (INFORMATIONAL)	10	1.85E+04	53.99	1.85E+03	539.90	NPRD-2016 P2960-23	0.25	0.25	0.00	1.00	0.05		1.55	0.99916386
4.7.8	STATION, COMMUNICATIONS	MICROPHONE	10	1.29E+06	0.77	1.29E+05	7.75	NPRD-2016 P1992 26	0.25	0.25	0.00	1.00	0.05		1.55	0.99998799
4.7.9	STATION, COMMUNICATIONS	INTERCOM STATION OUTLET (LOCAL)	10	4.04E+03	247.65	4.04E+02	2476.47	NPRD-2016 P1826-44	0.25	0.25	0.00	1.00	0.05		1.55	0.99617614
4.7.10	STATION, COMMUNICATIONS	INTERCOM STATION OUTLET (SLAVE)	10	4.04E+03	247.65	4.04E+02	2476.47	NPRD-2016 P1826-44	0.25	0.25	0.00	1.00	0.05		1.55	0.99617614
4.7.11	STATION, COMMUNICATIONS	INTERCOM STATION OUTLET (MASTER)	10	4.04E+03	247.65	4.04E+02	2476.47	NPRD-2016 P1826-44	0.25	0.25	0.00	1.00	0.05		1.55	0.99617614
4.7.12	STATION, COMMUNICATIONS	SPEAKER- CEILING MOUNTED	10	1.60E+04	62.39	1.60E+03	623.91	NPRD-2016 P2319-50	0.25	0.25	0.00	1.00	0.05		1.55	0.99903388
4.7.13	STATION, COMMUNICATIONS	SPEAKER- WALL MOUNTED	10	1.60E+04	62.39	1.60E+03	623.91	NPRD-2016 P2319-50	0.25	0.25	0.00	1.00	0.05		1.55	0.99903388
4.7.14	STATION, COMMUNICATIONS	AMBIENT LEVEL SENSOR	10	1.60E+04	62.39	1.60E+03	623.91	NPRD-2016 P2319-50	0.25	0.25	0.00	1.00	0.05		1.55	0.99903388
4.7.15	STATION, COMMUNICATIONS	PROGRAM HORN, PUBLIC ADDRESS SYSTEM	10	1.60E+04	62.39	1.60E+03	623.91	NPRD 2016 P2319-50	0.25	0.25	0.00	1.00	0.05		1.55	0.99903388
4.7.16	STATION, COMMUNICATIONS	PASSENGER INFORMATION DISPLAY	10	2.87E+05	3.48	2.87E+04	34.83	NPRD-2016 P2033-65	0.25	0.25	0.00	1.00	0.05		1.55	0.99994602
4.7.17	STATION, COMMUNICATIONS	AMBIENT NOISE COMPENSATOR	10	1.60E+04	62.39	1.60E+03	623.91	NPRD-2016 P2059-20	0.25	0.25	0.00	1.00	0.05		1.55	0.99903388
4.7.18	STATION, COMMUNICATIONS	PROGRAM BELL, PUBLIC ADDRESS SYSTEM	10	1.60E+04	62.39	1.60E+03	623.91	NPRD-2016 P2319-50	0.25	0.25	0.00	1.00	0.05		1.55	0.99903388
4.7.19	STATION, COMMUNICATIONS	POWER CONNECTION, CLOCK	10	1.78E+05	5.61	1.78E+04	56.09	NPRD-2016 P524 60	0.25	0.25	0.00	1.00	0.05		1.55	0.99991307
4.7.20	STATION, COMMUNICATIONS	POWER CONNECTION, DOUBLE FACE CLOCK	10	1.78E+05	5.61	1.78E+04	56.09	NPRD-2016 P524-60	0.25	0.25	0.00	1.00	0.05		1.55	0.99991307
5.1.	COMMS - CTS	COMMUNICATION TRANSMISSION SYSTEM				#DIV/0!										
5.1.1	COMMS - CTS	FIBRE OPTIC INFRASTRUCTURE CABLE	10	4.73E+05	2.11	4.73E+04	21.14	NPRD_2016 P431-38	0.25	0.25	0.15	0.25	0.05		0.95	0.99999799
5.1.2	COMMS - CTS	CTS RACK 1	1	1.92E+08	0.01	1.92E+08	0.01	NPRD_2016 P2360-65	0.25	0.25	0.05	8.00	0.05		8.60	0.99999996
5.1.3	COMMS - CTS	CTS RACK 2	1	1.92E+08	0.01	1.92E+08	0.01	NPRD_2016 P2360-65	0.25	0.25	0.05	8.00	0.05		8.60	0.99999996
5.1.4	COMMS - CTS	FIBRE ENTRANCE CABINET 1	1	1.92E+08	0.01	1.92E+08	0.01	NPRD_2016 P2360-65	0.25	0.25	0.05	8.00	0.05		8.60	0.99999996
5.1.5	COMMS - CTS	FIBRE ENTRANCE CABINET 2	1	1.92E+08	0.01	1.92E+08	0.01	NPRD_2016 P2360 65	0.25	0.25	0.05	8.00	0.05		8.60	0.99999996
5.1.6	COMMS - CTS	NETWORK SWITCHES	8	8.32E+04	12.02	1.04E+04	96.18	NPRD_2016 P2882-75	0.25	0.25	0.05	0.50	0.05		1.10	0.99998677
5.1.7	COMMS - CTS	ROUTERS	4	2.37E+06	0.42	5.91E+05	1.69	NPRD_2016 P1748-77	0.25	0.25	0.05	0.50	0.05		1.10	0.99999953
5.1.8	COMMS - CTS	FIREWALLS	2	2.00E+05	5.00	1.00E+05	10.00	OEM Data	0.25	0.25	0.05	0.50	0.05		1.10	0.99999450
5.1.9	COMMS - CTS	NETWORK TIME SERVER	2	1.04E+06	0.96	5.19E+05	1.93	OEM Data	0.25	0.25	0.05	0.50	0.05		1.10	0.99999894
5.1.10	COMMS - CTS	ICP MICROPHONE	2	2.41E+05	4.16	1.20E+05	8.31	NPRD_2016 P1992-25	0.25	0.25	0.05	0.25	0.05		0.85	0.99999647

Ref.	System	Description	QPU	MTBF (hrs)	FR A	Total MTBF	A x QTY	Data Source	Logistic	Access	Isolation	Remove & Replace	Alignment	Test	TOTAL	Availability
5.1.11	COMMS - CTS	MICROPHONE CONSOLE	1	5.74E+06	0.17	5.74E+06	0.17	NPRD_2016 P1993-31	0.25	0.25	0.05	0.25	0.05		0.85	0.99999985
5.2	COMMS - SCADA	SUPERVISORY CONTROL AND DATA ACQUISITION	1	1.00E+08	0.01	1.00E+08	0.01									1.00000000
5.2.1	COMMS - SCADA	SCADA SERVERS	2	1.04E+06	0.96	5.19E+05	1.93	OEM Data	0.25	0.25	0.05	0.33	0.05		0.93	0.99999910
5.2.2	COMMS - SCADA	PC WORKSTATION	1	2.70E+04	37.00	2.70E+04	37.00	OEM Data	0.25	0.25	0.05	0.25	0.05		0.85	0.99996855
5.3.	COMMS - TELEPHONE & INTERCOM	TELEPHONES	1	1.00E+08	0.01	1.00E+08	0.01									1.00000000
5.3.1	COMMS - TELEPHONE & INTERCOM	EMERGENCY TELEPHONES (ETEL)	3	1.85E+05	5.40	6.17E+04	16.20	NPRD_2016 P2960-23	0.25	0.25	0.05	0.15	0.05		0.75	0.99999595
5.3.2	COMMS - TELEPHONE & INTERCOM	ELEVATOR HELP INTERCOMS (EHFI)	2	1.85E+05	5.40	9.26E+04	10.80	Included in 3.01	0.25	0.25	0.05	0.25	0.05		0.85	0.99999541
5.3.3	COMMS - TELEPHONE & INTERCOM	INFORMATION TELEPHONES (ITEL)	2	1.85E+05	5.40	9.26E+04	10.80	Included in 3.01	0.25	0.25	0.05	0.15	0.05		0.75	0.99999595
5.3.4	COMMS - TELEPHONE & INTERCOM	STAFF TELEPHONES (STEL)	3	1.85E+05	5.40	6.17E+04	16.20	Included in 3.01	0.25	0.25	0.05	0.05	0.05		0.65	0.99999649
5.3.5	COMMS - TELEPHONE & INTERCOM	MAINTENANCE TELEPHONES (MTEL)	2	1.85E+05	5.40	9.26E+04	10.80	Included in 3.01	0.25	0.25	0.05	0.15	0.05		0.75	0.99999595
5.3.6	COMMS - TELEPHONE & INTERCOM	YARD INTERCOMS (HFI)	2	1.85E+05	5.40	9.26E+04	10.80	Included in 3.01	0.25	0.25	0.05	0.25	0.05		0.85	0.99999541
5.3.7	COMMS - TELEPHONE & INTERCOM	FIREFIGHTER TELEPHONE (FTEL)	2	1.85E+05	5.40	9.26E+04	10.80	Included in 3.01	0.25	0.25	0.05	0.15	0.05		0.75	0.99999595
5.3.8	COMMS - TELEPHONE & INTERCOM	ETEL-ITEL	2	1.85E+05	5.40	1.45E+06	0.69	Included in 3.01	0.25	0.25	0.05	0.15	0.05		0.75	0.99999595
5.3.9	COMMS - TELEPHONE & INTERCOM	PABX (PUBLIC BRANCH EXCHANGE)	1	2.90E+06	0.34	2.90E+06	0.34	NPRD_2016 P2960-72	0.25	0.25	0.05	0.25	0.05		0.85	0.99999971
5.4.1	COMMS - PA	SPEAKER	63	1.60E+05	6.24	2.54E+03	393.05	NPRD_2016 P2319-50	0.25	0.25	0.05	0.10	0.05		0.70	0.99999563
5.4.2	COMMS - PA	JUNCTION BOX	1	2.87E+06	0.35	2.87E+06	0.35	NPRD_2016 P1845-33	0.25	0.25	0.05	0.33	0.05		0.93	0.99999968
5.4.3	COMMS - PA	AMBIENT NOISE COMPENSATOR MICROPHONE	1	2.41E+06	0.42	2.41E+06	0.42	NPRD 2016 P1992-27	0.25	0.25	0.05	0.25	0.05		0.85	0.99999965
5.5.1	COMMS - PIDS	SIGN, PASSENGER INFORMATION DISPLAY	4	3.05E+05	3.28	7.61E+04	13.13	NPRD_2016 P839-53	0.25	0.25	0.05	1.00	0.05		1.60	0.99999475
5.5.2	COMMS - PIDS	SCREEN, PASSENGER INFORMATION DISPLAY	4	3.05E+05	3.28	7.61E+04	13.13	NPRD_2016 P839-53	0.25	0.25	0.05	0.33	0.05		0.93	0.99999695
5.5.3	COMMS - PIDS	PIS SERVER	1	1.04E+06	0.96	1.04E+06	0.96	OEM Data	0.25	0.25	0.05	0.33	0.05		0.93	0.99999910
5.5.4	COMMS - PIDS	NAC - NETWORK AUDIO CONTROLLER	1	2.90E+06	0.34	2.90E+06	0.34	NPRD_2016 P2960-72	0.25	0.25	0.05	0.50	0.05		1.10	0.99999962
5.5.5	COMMS - PIDS	GRAPHICAL USER INTERFACE	1	3.05E+05	3.28	3.05E+05	3.28	NPRD_2016 P839-53	0.25	0.25	0.05	0.10	0.05		0.70	0.99999770
5.6.	COMMS - CCTV	CLOSED CIRCUIT TELEVISION SYSTEM														
5.6.1	COMMS - CCTV	CAMERAS	84	3.81E+05	2.63	4.53E+03	220.58	NPRD_2016 P457-14	0.25	0.25	0.05	0.10	0.05		0.70	0.99999816
5.6.2	COMMS - CCTV	CONTROL SERVER, VIDEO MANAGEMENT SYSTEM	1	1.04E+06	0.96	1.04E+06	0.96	OEM Data	0.25	0.25	0.05	0.33	0.05		0.93	0.99999910
5.6.3	COMMS - CCTV	WORKSTATION, IPVS (INTERNET PROTOCOL VIDEO SYSTEM)	1	2.14E+04	46.72	2.14E+04	46.72	NPRD_2016 P3280-50	0.25	0.25	0.05	0.25	0.05		0.85	0.99996029
5.6.4	COMMS - CCTV	NETWORK VIDEO RECORDER	1	8.61E+06	0.12	8.61E+06	0.12	NPRD_2016 P485-9	0.25	0.25	0.05	0.33	0.05		0.93	0.99999989
5.7.	COMMS - IAC	INTRUSION ACCESS CONTROL														
5.7.1	COMMS - IAC	IAC SERVER	2	1.04E+06	0.96	5.19E+05	1.93	OEM Data	0.25	0.25	0.05	0.33	0.05	0.00	0.93	0.99999910
5.7.2	COMMS - IAC	DOOR CONTROLLER	1	3.13E+05	3.20	3.13E+05	3.20	NPRD_2016 P617-26	0.25	0.25	0.05	0.60	0.05	0.00	1.20	0.99999617
5.7.3	COMMS - IAC	CARD READER	31	5.91E+05	1.69	1.91E+04	52.43	NPRD_2016 P466-20	0.25	0.25	0.05	0.25	0.05	0.00	0.85	0.99999856
5.7.4	COMMS - IAC	REQUEST-TO-EXIT SYSTEM	2	5.91E+05	1.69	2.96E+05	3.38	NPRD_2016 P466-20	0.25	0.25	0.05	0.33	0.05	0.00	0.93	0.99999843
5.7.5	COMMS - IAC	ACCESS CARD	40	1.34E+06	0.75	3.34E+04	29.90	NPRD_2016 P5-35	0.25	0.25	0.05	0.25	0.05	0.00	0.85	0.99999936
5.8.	COMMS - GIDS	GUIDE WAY INTRUSION DETECTION SYSTEM														
5.8.1	COMMS - GIDS	LASER MEASUREMENT SCANNER	4	1.01E+05	9.89	2.53E+04	39.56	NPRD_2016 P621-26	0.25	0.25	0.05	1.00	0.05	0.00	1.60	0.99998418
5.8.2	COMMS - GIDS	DUST SHIELD, MODEL HT1-511	4	1.01E+05	9.89	2.53E+04	39.56	NPRD_2016 P621-26	0.25	0.25	0.05		0.05	0.00	0.60	0.99999407
5.8.3	COMMS - GIDS	PIU 30 JUNCTION BOX INTERFACE	4	2.87E+06	0.35	7.18E+05	1.39	NPRD_2016 P1845-33	0.25	0.25	0.05		0.05	0.00	0.60	0.99999979
6.1.1	TRACK - RAIL	RUNNING RAILS	25	1.25E+06	0.80	1.25E+06	0.80	NPRD-2016 P2368-79	1.00	0.50	0.00	7.50	0.05	0.00	8.00	0.99999362
6.1.2	TRACK - RAIL	JORDAN GUARDRAILS	2.50	7.52E+05	1.33	3.01E+05	3.33	NPRD-2016 P1604-60	1.00	0.50	0.00	3.50	0.05	0.00	4.00	0.99998670
6.1.3	TRACK - DIRECT FIX	INSULATED BONDED JOINTS	14	6.67E+05	1.50	4.76E+04	21.00	NPRD-2016 P2096-39	1.00	0.50	0.00	1.50	0.05	0.00	2.00	0.99995800
6.1.4	TRACK - DIRECT FIX	SLIDING RAIL EXPANSION JOINTS	4	4.65E+05	2.15	1.16E+05	8.60	NPRD-2016 P3002-63	1.00	0.50	0.00	11.50	0.05	0.00	12.00	0.99989681
6.1.5	TRACK - DIRECT FIX	RUBBER TRACK COMPONENTS	59562	2.22E+10	0.00	3.73E+05	2.68	Engineering Judgement	1.00	0.50	0.00	3.50	0.05	0.00	4.00	0.99998928
6.1.6	TRACK -DIRECT FIX	POLYURETHANE GROUT	309	4.94E+07	0.02	1.60E+05	6.25	Engineering Judgement	1.00	0.50	0.00	1.50	0.05	0.00	2.00	0.99998750
6.1.7	TRACK - DIRECT FIX	INSERTS	3590	1.25E+08	0.01	3.49E+04	28.63	Engineering Judgement	1.00	0.50	0.00	1.50	0.05	0.00	2.00	0.99994274
6.1.8	TRACK - DIRECT FIX	1) DIRECT FIX FASTENER, 2) BONDED DIRECT FIX FASTENER, 3)J-CLIPS	143846	4.00E+09	0.00	2.78E+04	35.96	Engineering Judgement	1.00	0.50	0.00	3.50	0.05	0.00	4.00	0.99985617
6.1.9	TRACK-TIES	CONCRETE TIES	29781	2.56E+08	0.00	8.59E+03	116.47	OEM Data	1.00	0.50	0.00	3.50	0.05	0.00	4.00	0.99953432
6.1.10	TRACK -BALLAST	BALLAST	12.50	1.25E+07	0.08	1.00E+06	1.00	Engineering Judgement	1.00	0.50	0.00	4.50	0.05	0.00	5.00	0.99999502
6.1.11	TRACK - DIRECT FIXATION	HDPE SHIMS	16707	2.22E+10	0.00	1.33E+06	0.75	NPRD-2016 P2253-14	1.00	0.50	0.00	1.50	0.05	0.00	2.00	0.99999850

Ref.	System	Description	QPU	MTBF (hrs)	FR A	Total MTBF	λ x QTY	Data Source	Logistic	Access	Isolation	Remove & Replace	Alignment	Test	TOTAL	Availability
6.1.12	TRACK - HOT AIR	GAS SWITCH HEATERS	29	1.47E+06	0.41	8.48E+04	11.80	Engineering Judgement	1.00	0.50	0.00	3.50	0.05	0.00	4.00	0.99995281
6.1.13	TRACK - HOT AIR	HOT AIR ELECTRIC SWITCH HEATERS	30	1.47E+06	0.41	8.19E+04	12.20	NPRD-2016 P1666-39	1.00	0.50	0.00	3.50	0.05	0.00	4.00	0.99995119
6.1.14	TRACK - DIRECT FIXATION	RAIL ANCHOR	4	2.87E+06	0.35	7.18E+05	1.39	NPRD-2016 P2369-16	1.00	0.50	0.00	11.50	0.05	0.00	12.00	0.99998328
6.1.15	TRACK- RAIL	END-OF-TRACK PROTECTION DEVICES	41	5.47E+07	0.02	1.33E+06	0.75	Engineering Judgement	1.00	0.50	0.00	7.50	0.05	0.00	8.00	0.99999400
6.1.16	TRACK - DIRECT FIXATION	BONDED RAIL JOINT	64	2.87E+06	0.35	4.49E+04	22.29	NPRD-2016 P2369-16	1.00	0.50	0.00	1.50	0.05	0.00	2.00	0.99995542
6.1.17	TRACK - SPECIAL TRACK WORK	TRACK - SPECIAL TRACK WORK (SWITCH, SWITCH MACHINE/ DETECTION, ETC)	30	6.44E+04	15.54	2.15E+03	466.17	NPRD-2016 P2369-16	1.00	0.50	0.00	0.50		0.00	2	0.99582199
7.1	SIGNALLING - SUBRACK ASSY MPU 24 2/3	SUBRACK ASSY-MPU 24V INPUT 2 OF 3	1	4.87E+04	20.55	4.87E+04	20.55									1.00000000
7.1.1.1	SIGNALLING - SUBRACK ASSY MPU 24 2/3	SUBRACK-MPU	1	1.64E+06	0.61	1.64E+06	0.61		0.25	0.02	0.02	0.10	0.00	0.10	0.49	0.99999970
7.1.1.1.1	SIGNALLING - SUBRACK ASSY MPU 24 2/3	PBA-MPU MOTHERBOARD	1	2.42E+06	0.41	2.42E+06	0.41	MIL-HDBK-217F								1.00000000
7.1.1.1.2	SIGNALLING - SUBRACK ASSY MPU 24 2/3	CABLE ASSEMBLY-MPU MOTHERBOARD I/F CAN	1	5.00E+08	0.00	5.00E+08	0.00	Demonstrated field data	0.25	0.25	0.00	0.20	0.00	0.10	0.80	1.00000000
7.1.1.1.3	SIGNALLING - SUBRACK ASSY MPU 24 2/3	CABLE ASSEMBLY-MPU MOTHERBOARD I/F POWER	1	5.00E+08	0.00	5.00E+08	0.00	Demonstrated field data	0.25	0.25	0.00	0.20	0.00	0.10	0.80	1.00000000
7.1.1.2	SIGNALLING - SUBRACK ASSY MPU 24 2/3	PBA-EPCM (12HP F/F EMI/HEATSINK/CC)	3	1.74E+05	5.76	5.79E+04	17.28	OEM Data	0.25	0.10	0.00	0.20	0.00	0.20	0.75	0.99999568
7.1.1.3	SIGNALLING - SUBRACK ASSY MPU 24 2/3	PBA-PSU 5V@4A OUTPUT 24V/36V I/P	3	1.51E+06	0.66	5.04E+05	1.98	MIL-HDBK-217F	0.25	0.10	0.00	0.20	0.00	0.10	0.65	0.99999957
7.1.1.4	SIGNALLING - SUBRACK ASSY MPU 24 2/3	PBA-CHANNEL SELECT 24V INPUT	1	5.00E+06	0.20	5.00E+06	0.20	MIL-HDBK-217F	0.25	0.25	0.00	0.20	0.00	0.10	0.80	0.99999984
7.1.1.5	SIGNALLING - SUBRACK ASSY MPU 24 2/3	PBA-ETHERNET ROUTE 1 CHANNEL	1	1.67E+07	0.06	1.67E+07	0.06	MIL-HDBK-217F	0.25	0.10	0.00	0.20	0.00	0.10	0.65	0.99999996
7.1.1.6	SIGNALLING - SUBRACK ASSY MPU 24 2/3	CABLE ASSEMBLY-MPU/CSS I/F REPLICA 1	1	5.00E+08	0.00	5.00E+08	0.00	Demonstrated field data	0.25	0.25	0.00	0.20	0.00	0.10	0.80	1.00000000
7.1.1.7	SIGNALLING - SUBRACK ASSY MPU 24 2/3	CABLE ASSEMBLY-MPU/CSS I/F REPLICA 2	1	5.00E+08	0.00	5.00E+08	0.00	Demonstrated field data	0.25	0.25	0.00	0.20	0.00	0.10	0.80	1.00000000
7.1.1.8	SIGNALLING - SUBRACK ASSY MPU 24 2/3	CABLE ASSEMBLY-MPU/CSS I/F REPLICA 3	1	5.00E+08	0.00	5.00E+08	0.00	Demonstrated field data	0.25	0.25	0.00	0.20	0.00	0.10	0.80	1.00000000
7.2	SIGNALLING - SUBRACK ASSY PPU/VIM 24V	SUBRACK ASSY-O/B PPU/VIM 2/2 3 SS	1	3.60E+04	27.77	3.60E+04	27.77									1.00000000
7.2.1.1	SIGNALLING - SUBRACK ASSY PPU/VIM 24V	SUBRACK-ONBOARD PPU VIM 3/3	1	1.04E+06	0.96	1.04E+06	0.96		0.25	0.25	0.00	0.50	0.00	0.10	1.10	0.99999894
7.2.1.1.1	SIGNALLING - SUBRACK ASSY PPU/VIM 24V	PBA-PPU/VIM MOTHERBOARD	1	1.06E+06	0.95	1.06E+06	0.95	MIL-HDBK-217F								1.00000000
7.2.1.1.2	SIGNALLING - SUBRACK ASSY PPU/VIM 24V	CABLE ASSEMBLY-PPU M/B INTERFACE 16I/O	6	5.00E+08	0.00	8.33E+07	0.01	MIL-HDBK-217F	0.25	0.25	0.00	0.20	0.00	0.10	0.80	1.00000000
7.2.1.1.3	SIGNALLING - SUBRACK ASSY PPU/VIM 24V	CABLE ASSEMBLY-PPU M/B I/F ACCEL/SS	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.25	0.00	0.20	0.00	0.10	0.80	1.00000000
7.2.1.1.4	SIGNALLING - SUBRACK ASSY PPU/VIM 24V	CABLE ASSEMBLY-PPU M/B I/F PASC/PROX/TI	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.25	0.00	0.20	0.00	0.10	0.80	1.00000000
7.2.1.1.5	SIGNALLING - SUBRACK ASSY PPU/VIM 24V	CABLE ASSEMBLY-PPU M/B INTERFACE CSS	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.25	0.00	0.20	0.00	0.10	0.80	1.00000000
7.2.1.1.6	SIGNALLING - SUBRACK ASSY PPU/VIM 24V	CABLE ASSEMBLY-PPU M/B INTERFACE VID	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.25	0.00	0.20	0.00	0.10	0.80	1.00000000
7.2.1.1.7	SIGNALLING - SUBRACK ASSY PPU/VIM 24V	CABLE ASSEMBLY-PPU M/B I/F POWER/CAN	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.25	0.00	0.20	0.00	0.10	0.80	1.00000000
7.2.1.1.8	SIGNALLING - SUBRACK ASSY PPU/VIM 24V	CABLE ASSEMBLY-PPU MOTHERBOARD PWM	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.25	0.00	0.20	0.00	0.10	0.80	1.00000000
7.2.1.2	SIGNALLING - SUBRACK ASSY PPU/VIM 24V	PBA-PICC	3	1.36E+06	0.74	4.52E+05	2.21	MIL-HDBK-217F	0.25	0.25	0.00	0.10	0.00	0.20	0.80	0.99999941
7.2.1.3	SIGNALLING - SUBRACK ASSY PPU/VIM 24V	PBA-PCM/PSU 24V/36V I/P TYPE A	3	1.23E+06	0.82	4.08E+05	2.45	MIL-HDBK-217F	0.25	0.25	0.00	0.10	0.00	0.20	0.80	0.99999935
7.2.1.4	SIGNALLING - SUBRACK ASSY PPU/VIM 24V	PBA-DISCONNECT 24V I/P	1	1.02E+06	0.98	1.02E+06	0.98	MIL-HDBK-217F	0.25	0.25	0.00	0.10	0.00	0.20	0.80	0.99999922
7.2.1.5	SIGNALLING - SUBRACK ASSY PPU/VIM 24V	PBA-32 I/P 16 O/P	6	4.98E+06	0.20	8.29E+05	1.21	MIL-HDBK-217F	0.25	0.25	0.00	0.10	0.00	0.20	0.80	0.99999984
7.2.1.6	SIGNALLING - SUBRACK ASSY PPU/VIM 24V	PBA-POWER DISTRIBUTION 3 REPLICA LV	1	4.00E+06	0.25	4.00E+06	0.25	MIL-HDBK-217F	0.25	0.25	0.00	0.10	0.00	0.20	0.80	0.99999980
7.2.1.7	SIGNALLING - SUBRACK ASSY PPU/VIM 24V	PBA-VIM 1 INPUT FILTER 24V	2	2.93E+05	3.42	1.46E+05	6.83	MIL-HDBK-217F	0.25	0.25	0.00	0.10	0.00	0.20	0.80	0.99999727
7.2.1.8	SIGNALLING - SUBRACK ASSY PPU/VIM 24V	PBA-VIM 2 OUTPUT RELAY 24V	2	2.74E+05	3.65	1.37E+05	7.30	MIL-HDBK-217F	0.25	0.25	0.00	0.10	0.00	0.20	0.80	0.99999708
7.2.1.9	SIGNALLING - SUBRACK ASSY PPU/VIM 24V	PBA-VIM 3 ONBOARD TYPE 7	1	1.54E+05	6.51	1.54E+05	6.51	MIL-HDBK-217F	0.25	0.25	0.00	0.10	0.00	0.20	0.80	0.99999479
7.3	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	RACK ASSEMBLY-VOBC (OLRT) MC1	76	9.54E+04	10.48	1.26E+03	796.55									1.00000000
7.3.1	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	MODULE-ETHERNET SW 12 PORT M12 LAYER2	1	5.44E+05	1.84	5.44E+05	1.84	OEM Data	0.25	0.02	0.02	0.05	0.00	0.10	0.44	0.99999919
7.3.2	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	FILTER-BANDPASS 8-POLE 2.40GHZ OUTDOOR	2	4.17E+06	0.24	2.08E+06	0.48	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999990
7.3.3	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	CBTC RADIO 1964500-901	1	6.58E+05	1.52	6.58E+05	1.52	OEM Data	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999929
7.3.4	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	CNVRTR-DC/DC 12V/12V O/P 100W	1	3.50E+05	2.86	3.50E+05	2.86	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999880
7.3.5	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	KIT-VID CONNECTOR	1	1.08E+07	0.09	1.08E+07	0.09		0.25	0.02	0.02	0.05	0.00	0.10	0.44	0.99999996

Ref.	System	Description	QPU	MTBF (hrs)	FR A	Total MTBF	λ x QTY	Data Source	Logistic	Access	Isolation	Remove & Replace	Alignment	Test	TOTAL	Availability
7.3.6	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	MODULE-GATEWAY MVB TO 2 ETHERNET W/O MSG	2	9.30E+05	1.08	4.65E+05	2.15	OEM Data	0.25	0.02	0.02	0.05	0.00	0.10	0.44	0.99999953
7.3.7	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	RELAY-DPDT 3A 72V/24V 290R	16	1.75E+07	0.06	1.10E+06	0.91	MIL-HDBK-217F	0.25	0.02	0.02	0.05	0.00	0.05	0.39	0.99999998
7.3.8	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	SOCKET-RELAY 2PDT TYPE FD470	16	1.00E+09	0.00	6.25E+07	0.02	MIL-HDBK-217F	0.25	0.02	0.02	0.05	0.00	0.05	0.39	1.00000000
7.3.9	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	RELAY-SPDT DB-DM 3A 24V 320OHM AU	9	1.75E+07	0.06	1.95E+06	0.51	MIL-HDBK-217F	0.25	0.02	0.02	0.05	0.00	0.05	0.39	0.99999998
7.3.10	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	SOCKET-RELAY 2PDT TYPE F370	9	1.00E+09	0.00	1.11E+08	0.01	MIL-HDBK-217F	0.25	0.02	0.02	0.05	0.00	0.05	0.39	1.00000000
7.3.11	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	CONTACT-RELAY SOCKET 18-16 AWG	54	1.00E+09	0.00	1.85E+07	0.05	MIL-HDBK-217F	0.25	0.02	0.02	0.05	0.00	0.05	0.39	1.00000000
7.3.12	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	KIT-CABLE (OLRT)	1	2.63E+07	0.04	2.63E+07	0.04	Demonstrated field data								1.00000000
7.3.13.1	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	CA-PPU/MPU CAN I/F	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.3.13.2	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	CA-POWER TIU 1	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.3.13.3	SIGNALLING - RACK ASSEMBLY VOBC (OLRT) MC1	CA-POWER NS 1	1	5.00E+08	0.00	5.00E+08	0.00	MIL HDBK 217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.3.13.4	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	CA-POWER MVB 1	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.3.13.5	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	CA-POWER MVB 2	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.3.13.6	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	CA-POWER MRU 1	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.3.13.7	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	CA-PPU/VIM P8	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.3.13.8	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	CA-PPU/VIM P7	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.3.13.9	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	CA-PPU/VIM P6	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.3.13.10	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	CA-PPU/VIM PS	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.3.13.11	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	CA-PPU/VIM P3	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.3.13.12	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	CA-PPU/VIM P2	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.3.13.13	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	CA-ETH MRU 1 VOBC	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.3.13.14	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	CA-ETH NS 1 VOBC	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.3.13.15	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	CA-ETH MRU 1 MVB1	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.3.13.16	SIGNALLING - RACK ASSEMBLY VOBC (OLRT) MC1	CA-ETH NS 1 MVB 2	1	5.00E+08	0.00	5.00E+08	0.00	MIL HDBK 217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.3.13.17	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	CA-FIL 2 MRU 1	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.3.13.18	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	CA-FIL 1 MRU 1	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000

Ref.	System	Description	QPU	MTBF (hrs)	FR λ	Total MTBF	λ x QTY	Data Source	Logistic	Access	Isolation	Remove & Replace	Alignment	Test	TOTAL	Availability
7.3.13.19	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC1	CA-ETHERNET-B3	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.4	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC2	RACK ASSEMBLY-VOBC (OLRT) MC2	76	5.91E+04	16.93	7.77E+02	1286.52									1.00000000
7.4.1	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC2	ASSY-VID PLUG	1	1.00E+08	0.01	1.00E+08	0.01	MIL-HDBK-217F	0.25	0.02	0.02	0.05	0.00	0.10	0.44	1.00000000
7.4.2	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC2	PC-LDC ARM3715 4G FLASH 16-60VDC	1	9.80E+04	10.20	9.80E+04	10.20	MIL-HDBK-217F	0.25	0.02	0.02	0.05	0.00	0.05	0.39	0.99999602
7.4.3	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC2	FILTER-BANDPASS 8-POLE 2.40GHZ OUTDOOR	2	4.17E+06	0.24	2.08E+06	0.48	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999990
7.4.4	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC2	MODULE-ETHERNET SW 12 PORT M12 LAYER2	1	5.44E+05	1.84	5.44E+05	1.84	OEM Data	0.25	0.02	0.02	0.05	0.00	0.10	0.44	0.99999919
7.4.5	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC2	CBTC RADIO 1964500-901	1	6.58E+05	1.52	6.58E+05	1.52	Demonstrated field data	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999929
7.4.6	SIGNALLING - RACK ASSEMBLY VOBC (OLRT) MC2	CNVRTR DC/DC 12V/12V O/P 100W	1	3.50E+05	2.86	3.50E+05	2.86	OEM Data	0.25	0.02	0.02	0.05	0.00	0.05	0.39	0.99999889
7.4.7	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC2	KIT-CABLE MC2 (OLRT)	1	4.55E+07	0.02	4.55E+07	0.02	Demonstrated field data								1.00000000
7.4.7.1	SIGNALLING - RACK ASSEMBLY VOBC (OLRT) MC2	CA-POWER TIU 2	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.4.7.2	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC2	CA-POWER NS 2	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.4.7.3	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC2	CA-POWER LDC	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.4.7.4	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC2	CA-POWER MRU 2	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.4.7.5	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC2	CA-TI I/O	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.4.7.6	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC2	CABLE ASSEMBLY-TI RS-232	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.4.7.7	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC2	CA-ETH NS 2 LDC	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.4.7.8	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC2	CA-ETH MRU 2 LDC	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.4.7.9	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC2	CA-ETHERNET-A3	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.4.7.10	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC2	CA-FIL 4 MRU 2	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.4.7.11	SIGNALLING - RACK ASSEMBLY-VOBC (OLRT) MC2	CA-FIL 3 MRU 2	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.5	SIGNALLING - Peripherals	ANTENNA-WIFI 2.4-2.485GHZ 8.5DBI DIR	4	3.03E+07	0.03	7.58E+06	0.13	OEM Data	0.25	0.05	0.02	0.15	0.05	0.05	0.57	0.99999998
7.5.1	SIGNALLING - Peripherals	SPEED SENSOR-DUAL OUTPUT 40 TEETH 12VDC	3	1.72E+06	0.58	5.72E+05	1.75	Analogy to similar item	0.25	0.02	0.02	0.20	0.05	0.10	0.64	0.99999963
7.5.2	SIGNALLING - Peripherals	ASSY-VID PLUG	2	1.00E+08	0.01	5.00E+07	0.02	MIL-HDBK-217F	0.25	0.02	0.02	0.05	0.00	0.10	0.44	1.00000000
7.5.3	SIGNALLING - Peripherals	MODULE-TOD 6.5" 640x480 16-60VDC ROHS	2	1.00E+05	10.00	5.00E+04	20.00	Analogy to similar item	0.25	0.02	0.02	0.05	0.00	0.05	0.39	0.99999610
7.5.4	SIGNALLING - Peripherals	SPEAKER-6.5" 8 OHM TOD	2	1.00E+07	0.10	5.00E+06	0.20	MIL-HDBK-217F	0.25	0.02	0.02	0.10	0.00	0.05	0.44	0.99999996
7.5.5	SIGNALLING - Peripherals	ASSEMBLY-ACCELEROMETER	3	8.50E+04	11.77	2.83E+04	35.30	Analogy to similar item	0.25	0.05	0.02	0.05	0.05	0.05	0.47	0.99999447
7.5.6	SIGNALLING Peripherals	ANTENNA TI 902 928 MHZ AA3234	2	1.20E+05	8.33	6.00E+04	16.67	MIL-HDBK-217F	0.25	0.05	0.02	0.15	0.05	0.05	0.57	0.99999525
7.5.7	SIGNALLING - Peripherals	TRANSPONDER INTRRGTR 915MHZ 14-70V 3HS	2	8.76E+04	11.42	4.38E+04	22.83	OEM Data	0.25	0.02	0.02	0.10	0.00	0.10	0.49	0.99999441
7.6	SIGNALLING - University of Ottawa ZC	RACK ASSEMBLY-ZONE CONTROLLER UOT	2	1.00E+04	99.76	5.01E+03	199.52									1.00000000
7.6.1	SIGNALLING - University of Ottawa ZC	SUBRACK ASSEMBLY-ZC	1	3.90E+04	25.62	3.90E+04	25.62		0.25	0.02	0.02	0.10	0.00	0.10	0.49	0.99998745
7.6.1.1	SIGNALLING - University of Ottawa ZC	PBA-EPCM	2	1.00E+05	9.98	5.01E+04	19.95	MIL-HDBK-217F	0.25	0.01	0.00	0.15	0.00	0.10	0.51	0.99999491

Ref.	System	Description	QPU	MTBF (hrs)	FR A	Total MTBF	λ x QTY	Data Source	Logistic	Access	Isolation	Remove & Replace	Alignment	Test	TOTAL	Availability
7.6.1.2	SIGNALLING - University of Ottawa ZC	POWER SUPPLY MPU SUBRACK	2	5.95E+05	1.68	2.97E+05	3.36	MIL-HDBK-217F	0.25	0.01	0.00	0.05	0.00	0.10	0.41	0.99999931
7.6.1.3	SIGNALLING - University of Ottawa ZC	PBA-VITAL SUPERVISON CARD (VSC)	2	1.24E+06	0.81	6.18E+05	1.62	MIL-HDBK-217F	0.25	0.01	0.00	0.05	0.00	0.10	0.41	0.99999967
7.6.1.4	SIGNALLING - University of Ottawa ZC	MPU SUBRACK (EC)	1	1.47E+06	0.68	1.47E+06	0.68	MIL-HDBK-217F	0.25	0.01	0.00	0.10	0.00	0.10	0.46	0.99999969
7.6.2	SIGNALLING - University of Ottawa ZC	SUBRACK ASSEMBLY-FEC 2 IO	2	2.22E+06	0.45	1.11E+06	0.90	MIL-HDBK-217F	0.25	0.02	0.01	0.20	0.00	0.10	0.58	0.99999974
7.6.2.1	SIGNALLING - University of Ottawa ZC	PBA-FEC PSU	4	8.53E+05	1.17	2.13E+05	4.69	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.10	0.46	0.99999946
7.6.2.2	SIGNALLING - University of Ottawa ZC	PBA-FEC I/O AREMA	10	4.01E+05	2.50	4.01E+04	24.96	MIL-HDBK-217F	0.25	0.05	0.01	0.10	0.00	0.10	0.51	0.99999873
7.6.2.3	SIGNALLING - University of Ottawa ZC	PBA-FEC SIC LED	5	4.04E+05	2.48	8.08E+04	12.38	MIL-HDBK-217F	0.25	0.05	0.01	0.10	0.00	0.10	0.51	0.99999874
7.6.3	SIGNALLING - University of Ottawa ZC	TERM BLOCK-M4/6.D1 RM GREY	72	1.00E+10	0.00	1.39E+08	0.01	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.6.4	SIGNALLING - University of Ottawa ZC	CA-AREMA 10 I/P ZC ALARMS 2300MM	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.6.5	SIGNALLING - University of Ottawa ZC	CA-AREMA 10I/P 2300MM	9	5.00E+08	0.00	5.56E+07	0.02	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.6.6	SIGNALLING - University of Ottawa ZC	CA-AREMA 10 O/P 2300MM	10	5.00E+08	0.00	5.00E+07	0.02	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.6.7	SIGNALLING - University of Ottawa ZC	CABLE ASSEMBLY-SIC I/O O/P 2300MM	5	2.56E+07	0.04	5.13E+06	0.20	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	0.99999998
7.6.8	SIGNALLING - University of Ottawa ZC	PBA-VID	1	1.08E+07	0.09	1.08E+07	0.09		0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999996
7.6.9	SIGNALLING - University of Ottawa ZC	MODULE-SWITCH PSU TYP RSP120 EEC	1	5.19E+05	1.93	5.19E+05	1.93	OEM Data	0.25	0.02	0.05	0.05	0.00	0.05	0.42	0.99999919
7.6.10	SIGNALLING - University of Ottawa ZC	THERMOSTAT-55DEG C 120/240VAC BIMETAL NC	1	7.19E+06	0.14	7.19E+06	0.14	Analogy to similar item	0.25	0.02	0.05	0.05	0.00	0.05	0.42	0.99999994
7.6.11	SIGNALLING - University of Ottawa ZC	CIRCUIT BREAKER-1 POLE 4A TB (ROHS)	12	2.56E+07	0.04	2.14E+06	0.47	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	0.99999998
7.6.12	SIGNALLING - University of Ottawa ZC	CABLE ASSEMBLY-VSC INTERFACE-3000MM	2	5.00E+08	0.00	2.50E+08	0.00	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.6.13	SIGNALLING - University of Ottawa ZC	TERM BLOCK-M6/8.D1 RM GRAY	52	1.00E+10	0.00	1.92E+08	0.01	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.6.14	SIGNALLING - University of Ottawa ZC	TERM BLOCK-M6/8P GND RM YEL/GR	4	1.00E+10	0.00	2.50E+09	0.00	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.6.15	SIGNALLING - University of Ottawa ZC	POWER FILTER-80DB 0.15MHZ 250VAC 10A MIL	2	1.75E+06	0.57	8.76E+05	1.14	Analogy to similar item	0.25	0.08	0.02	0.08	0.00	0.05	0.48	0.99999973
7.6.16	SIGNALLING - University of Ottawa ZC	FAN TRAY-19" 1U 3X105 CFM FAN 90-264VAC	2	7.50E+04	13.33	3.75E+04	26.67	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999440
7.6.17	SIGNALLING - University of Ottawa ZC	CABLE ASSEMBLY-ETHERNETZC INTERNAL	6	5.00E+08	0.00	8.33E+07	0.01	MIL-HDBK-217F	0.25	0.10	0.02	0.20	0.00	0.05	0.62	1.00000000
7.6.18	SIGNALLING - University of Ottawa ZC	TERM BLOCK-M6/8.D2.1 RM GREY	50	1.00E+10	0.00	2.00E+08	0.01	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.6.19	SIGNALLING - University of Ottawa ZC	RELAY-DPDT 8A 24VDC DIN MOUNT	4	1.00E+07	0.10	2.50E+06	0.40	MIL-HDBK-217F	0.25	0.08	0.02	0.08	0.00	0.05	0.48	0.99999995
7.6.20	SIGNALLING - University of Ottawa ZC	CABLE-0.5MMSQ3CORE 300V MVB	10	5.00E+08	0.00	5.00E+07	0.02	MIL-HDBK-217F	0.25	0.10	0.02	0.20	0.00	0.05	0.62	1.00000000
7.6.21	SIGNALLING - University of Ottawa ZC	PBA-VID	1	1.08E+07	0.09	1.08E+07	0.09		0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999996
7.7	SIGNALLING - Tunney's Pasture (TUN) ZC	RACK ASSEMBLY-ZONE CONTROLLER TUV	1	7.47E+03	133.82	7.47E+03	133.82									1.00000000
7.7.1	SIGNALLING - Tunney's Pasture (TUN) ZC	SUBRACK ASSEMBLY-ZC	2	3.90E+04	25.62	1.95E+04	51.23		0.25	0.02	0.02	0.10	0.00	0.10	0.49	0.99998745
7.7.1.1	SIGNALLING - Tunney's Pasture (TUN) ZC	PBA-EPCM	2	1.00E+05	9.98	5.01E+04	19.95	OEM Data	0.25	0.01	0.00	0.15	0.00	0.10	0.51	0.99999491
7.7.1.2	SIGNALLING - Tunney's Pasture (TUN) ZC	POWER SUPPLY MPU SUBRACK	2	5.95E+05	1.68	2.97E+05	3.36	Analogy to similar item	0.25	0.01	0.00	0.05	0.00	0.10	0.41	0.99999931
7.7.1.3	SIGNALLING - Tunney's Pasture (TUN) ZC	PBA-VITAL SUPERVISON CARD (VSC)	2	1.24E+06	0.81	6.18E+05	1.62	MIL-HDBK-217F	0.25	0.01	0.00	0.05	0.00	0.10	0.41	0.99999967
7.7.1.4	SIGNALLING - Tunney's Pasture (TUN) ZC	MPU SUBRACK (EC)	1	1.47E+06	0.68	1.47E+06	0.68	MIL-HDBK-217F	0.25	0.01	0.00	0.10	0.00	0.10	0.46	0.99999969
7.7.2	SIGNALLING - Tunney's Pasture (TUN) ZC	SUBRACK ASSEMBLY-FEC 2 IO	2	2.22E+06	0.45	1.11E+06	0.90	MIL-HDBK-217F	0.25	0.02	0.01	0.20	0.00	0.10	0.58	0.99999974
7.7.2.1	SIGNALLING - Tunney's Pasture (TUN) ZC	PBA-FEC PSU	4	8.53E+05	1.17	2.13E+05	4.69	MIL HDBK 217F	0.25	0.05	0.01	0.05	0.00	0.10	0.46	0.99999946
7.7.2.2	SIGNALLING - Tunney's Pasture (TUN) ZC	PBA-FEC I/O AREMA	12	4.01E+05	2.50	3.34E+04	29.95	MIL-HDBK-217F	0.25	0.05	0.01	0.10	0.00	0.10	0.51	0.99999873
7.7.2.3	SIGNALLING - Tunney's Pasture (TUN) ZC	PBA-FEC SIC LED	6	4.04E+05	2.48	6.73E+04	14.86	MIL-HDBK-217F	0.25	0.05	0.01	0.10	0.00	0.10	0.51	0.99999874
7.7.3	SIGNALLING - Tunney's Pasture (TUN) ZC	TERM BLOCK-M4/6.D1 RM GREY	72	1.00E+10	0.00	1.39E+08	0.01	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.7.4	SIGNALLING - Tunney's Pasture (TUN) ZC	CA-AREMA 10 I/P ZC ALARMS 2300MM	2	5.00E+08	0.00	2.50E+08	0.00	MIL HDBK 217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.7.5	SIGNALLING - Tunney's Pasture (TUN) ZC	CA-AREMA 10 I/P 2300MM	10	5.00E+08	0.00	5.00E+07	0.02	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.7.6	SIGNALLING - Tunney's Pasture (TUN) ZC	CA-AREMA 10 O/P 2300MM	12	5.00E+08	0.00	4.17E+07	0.02	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.7.7	SIGNALLING - Tunney's Pasture (TUN) ZC	CABLE ASSEMBLY-SIC I/O O/P 2300MM	6	5.00E+08	0.00	8.33E+07	0.01	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.7.8	SIGNALLING - Tunney's Pasture (TUN) ZC	PBA-VID	2	1.08E+07	0.09	5.38E+06	0.19		0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999996
7.7.9	SIGNALLING - Tunney's Pasture (TUN) ZC	MODULE-SWITCH PSU TYP RSP120 EEC	1	5.19E+05	1.93	5.19E+05	1.93	OEM Data	0.25	0.02	0.05	0.05	0.00	0.05	0.42	0.99999919
7.7.10	SIGNALLING - Tunney's Pasture (TUN) ZC	THERMOSTAT-55DEG C 120/240VAC BIMETAL NC	1	7.19E+06	0.14	7.19E+06	0.14	Analogy to similar item	0.25	0.02	0.05	0.05	0.00	0.05	0.42	0.99999994
7.7.11	SIGNALLING - Tunney's Pasture (TUN) ZC	CIRCUIT BREAKER-1 POLE 4A TB (ROHS)	12	2.56E+07	0.04	2.14E+06	0.47	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	0.99999998
7.7.12	SIGNALLING - Tunney's Pasture (TUN) ZC	CABLE ASSEMBLY-VSC INTERFACE-3000MM	4	5.00E+08	0.00	1.25E+08	0.01	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.7.13	SIGNALLING - Tunney's Pasture (TUN) ZC	TERM BLOCK-M6/8.D1 RM GRAY	52	1.00E+10	0.00	1.92E+08	0.01	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.7.14	SIGNALLING - Tunney's Pasture (TUN) ZC	TERM BLOCK-M6/8P GND RM YEL/GR	4	1.00E+10	0.00	2.50E+09	0.00	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.7.15	SIGNALLING - Tunney's Pasture (TUN) ZC	POWER FILTER-80DB 0.15MHZ 250VAC 10A MIL	4	1.75E+06	0.57	4.38E+05	2.28	Analogy to similar item	0.25	0.08	0.02	0.08	0.00	0.05	0.48	0.99999973
7.7.16	SIGNALLING - Tunney's Pasture (TUN) ZC	FAN TRAY-19" 1U 3X105 CFM FAN 90-264VAC	2	7.50E+04	13.33	3.75E+04	26.67	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999440

OLR-05-0-0000-REP-0059	Interface Hazard Analysis	
Revision: 2	Date: 23 May 2019	Owner: M. Williamson

Ref.	System	Description	QPU	MTBF (hrs)	FR A	Total MTBF	λ x QTY	Data Source	Logistic	Access	Isolation	Remove & Replace	Alignment	Test	TOTAL	Availability
7.7.17	SIGNALLING - Tunney's Pasture (TUN) ZC	CABLE ASSEMBLY-ETHERNETZC INTERNAL	12	5.00E+08	0.00	4.17E+07	0.02	MIL-HDBK-217F	0.25	0.10	0.02	0.20	0.00	0.05	0.62	1.00000000
7.7.18	SIGNALLING - Tunney's Pasture (TUN) ZC	TERM BLOCK-M6/8.D2.1 RM GREY	50	1.00E+10	0.00	2.00E+08	0.01	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.7.19	SIGNALLING - Tunney's Pasture (TUN) ZC	RELAY-DPDT 8A 24VDC DIN MOUNT	4	1.00E+07	0.10	2.50E+06	0.40	MIL-HDBK-217F	0.25	0.08	0.02	0.08	0.00	0.05	0.48	0.99999995
7.7.20	SIGNALLING - Tunney's Pasture (TUN) ZC	CABLE-0.5MMSQ3CORE 300V MVB	10	5.00E+08	0.00	5.00E+07	0.02	MIL-HDBK-217F	0.25	0.10	0.02	0.20	0.00	0.05	0.62	1.00000000
7.8	SIGNALLING - Blair (BLR) ZC	RACK ASSEMBLY-ZONE CONTROLLER BLA	1	7.76E+03	128.82	7.76E+03	128.82									1.00000000
7.8.1	SIGNALLING - Blair (BLR) ZC	SUBRACK ASSEMBLY-ZC	2	3.90E+04	25.62	1.95E+04	51.23		0.25	0.02	0.02	0.10	0.00	0.10	0.49	0.99998745
7.8.1.1	SIGNALLING - Blair (BLR) ZC	PBA-EPCM	2	1.00E+05	9.98	5.01E+04	19.95	OEM Data	0.25	0.01	0.00	0.15	0.00	0.10	0.51	0.99999491
7.8.1.2	SIGNALLING - Blair (BLR) ZC	POWER SUPPLY MPU SUBRACK	2	5.95E+05	1.68	2.97E+05	3.36	MIL-HDBK-217F	0.25	0.01	0.00	0.05	0.00	0.10	0.41	0.99999931
7.8.1.3	SIGNALLING - Blair (BLR) ZC	PBA-VITAL SUPERVISON CARD (VSC)	2	1.24E+06	0.81	6.18E+05	1.62	MIL-HDBK-217F	0.25	0.01	0.00	0.05	0.00	0.10	0.41	0.99999967
7.8.1.4	SIGNALLING - Blair (BLR) ZC	MPU SUBRACK (EC)	1	1.47E+06	0.68	1.47E+06	0.68	MIL-HDBK-217F	0.25	0.01	0.00	0.10	0.00	0.10	0.46	0.99999969
7.8.2	SIGNALLING - Blair (BLR) ZC	SUBRACK ASSEMBLY-FEC 2 IO	2	2.22E+06	0.45	1.11E+06	0.90	MIL-HDBK-217F	0.25	0.02	0.01	0.20	0.00	0.10	0.58	0.99999974
7.8.2.1	SIGNALLING - Blair (BLR) ZC	PBA-FEC PSU	4	8.53E+05	1.17	2.13E+05	4.69	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.10	0.46	0.99999946
7.8.2.2	SIGNALLING - Blair (BLR) ZC	PBA-FECI/O AREMA	10	4.01E+05	2.50	4.01E+04	24.96	MIL-HDBK-217F	0.25	0.05	0.01	0.10	0.00	0.10	0.51	0.99999873
7.8.2.3	SIGNALLING - Blair (BLR) ZC	PBA-FEC SIC LED	6	4.04E+05	2.48	6.73E+04	14.86	MIL-HDBK-217F	0.25	0.05	0.01	0.10	0.00	0.10	0.51	0.99999874
7.8.3	SIGNALLING - Blair (BLR) ZC	TERM BLOCK-M4/6.D1 RM GREY	72	1.00E+10	0.00	1.39E+08	0.01	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.8.4	SIGNALLING - Blair (BLR) ZC	CA-AREMA 10 I/P ZC ALARMS 2300MM	2	5.00E+08	0.00	2.50E+08	0.00	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.8.5	SIGNALLING - Blair (BLR) ZC	CA-AREMA 10 I/P 2300MM	8	5.00E+08	0.00	6.25E+07	0.02	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.8.6	SIGNALLING - Blair (BLR) ZC	CA-AREMA 10 O/P 2300MM	10	5.00E+08	0.00	5.00E+07	0.02	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.8.7	SIGNALLING - Blair (BLR) ZC	CABLE ASSEMBLY-SIC I/O O/P 2300MM	6	5.00E+08	0.00	8.33E+07	0.01	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.8.8	SIGNALLING - Blair (BLR) ZC	PBA-VID	2	1.08E+07	0.09	5.38E+06	0.19		0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999996
7.8.9	SIGNALLING - Blair (BLR) ZC	MODULE-SWITCH PSU TYP RSP120 EEC	1	5.19E+05	1.93	5.19E+05	1.93	OEM Data	0.25	0.02	0.05	0.05	0.00	0.05	0.42	0.99999919
7.8.10	SIGNALLING - Blair (BLR) ZC	THERMOSTAT-55DEG C 120/240VAC BIMETAL NC	1	7.19E+06	0.14	7.19E+06	0.14	Analogy to similar item	0.25	0.02	0.05	0.05	0.00	0.05	0.42	0.99999994
7.8.11	SIGNALLING - Blair (BLR) ZC	CIRCUIT BREAKER-1 POLE 4A TB (ROHS)	12	2.56E+07	0.04	2.14E+06	0.47	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	0.99999998
7.8.12	SIGNALLING - Blair (BLR) ZC	CABLE ASSEMBLY-VSC INTERFACE-3000MM	4	5.00E+08	0.00	1.25E+08	0.01	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.8.13	SIGNALLING - Blair (BLR) ZC	TERM BLOCK-M6/8.D1 RM GRAY	52	1.00E+10	0.00	1.92E+08	0.01	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.8.14	SIGNALLING - Blair (BLR) ZC	TERM BLOCK-M6/8P GND RM YEL/GR	4	1.00E+10	0.00	2.50E+09	0.00	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.8.15	SIGNALLING - Blair (BLR) ZC	POWER FILTER-80DB 0.15MHZ 250VAC 10A MIL	4	1.75E+06	0.57	4.38E+05	2.28	Analogy to similar item	0.25	0.08	0.02	0.08	0.00	0.05	0.48	0.99999973
7.8.16	SIGNALLING - Blair (BLR) ZC	FAN TRAY-19" 1U 3X105 CFM FAN 90-264VAC	2	7.50E+04	13.33	3.75E+04	26.67	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999440
7.8.17	SIGNALLING - Blair (BLR) ZC	CABLE ASSEMBLY-ETHERNET ZC INTERNAL	12	5.00E+08	0.00	4.17E+07	0.02	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.8.18	SIGNALLING - Blair (BLR) ZC	TERM BLOCK-M6/8.D2.1 RM GREY	50	1.00E+10	0.00	2.00E+08	0.01	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.8.19	SIGNALLING - Blair (BLR) ZC	RELAY-DPDT 8A 24VDC DIN MOUNT	4	1.00E+07	0.10	2.50E+06	0.40	MIL-HDBK-217F	0.25	0.08	0.02	0.08	0.00	0.05	0.48	0.99999995
7.8.20	SIGNALLING - Blair (BLR) ZC	CABLE-0.5MMSQ 3CORE 300V MVB	10	5.00E+08	0.00	5.00E+07	0.02	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.9	SIGNALLING - MSF Yard SCR ZC	RACK ASSEMBLY-ZONE CONTROLLER YAR	1	5.87E+03	170.40	5.87E+03	170.40									1.00000000
7.9.1	SIGNALLING - MSF Yard SCR ZC	SUBRACK ASSEMBLY-ZC	2	3.90E+04	25.62	1.95E+04	51.23		0.25	0.02	0.02	0.10	0.00	0.10	0.49	0.99998745
7.9.1.1	SIGNALLING - MSF Yard SCR ZC	PBA-EPCM	2	1.00E+05	9.98	5.01E+04	19.95	OEM Data	0.25	0.01	0.00	0.15	0.00	0.10	0.51	0.99999491
7.9.1.2	SIGNALLING - MSF Yard SCR ZC	POWER SUPPLY MPU SUBRACK	2	5.95E+05	1.68	2.97E+05	3.36	MIL-HDBK-217F	0.25	0.01	0.00	0.05	0.00	0.10	0.41	0.99999931
7.9.1.3	SIGNALLING - MSF Yard SCR ZC	PBA-VITAL SUPERVISON CARD (VSC)	2	1.24E+06	0.81	6.18E+05	1.62	MIL-HDBK-217F	0.25	0.01	0.00	0.05	0.00	0.10	0.41	0.99999967
7.9.1.4	SIGNALLING - MSF Yard SCR ZC	MPU SUBRACK (EC)	1	1.47E+06	0.68	1.47E+06	0.68	MIL HDBK 217F	0.25	0.01	0.00	0.10	0.00	0.10	0.46	0.99999969
7.9.2	SIGNALLING - MSF Yard SCR ZC	SUBRACK ASSEMBLY-FEC 2 IO	2	2.22E+06	0.45	1.11E+06	0.90		0.25	0.02	0.01	0.20	0.00	0.10	0.58	0.99999974
7.9.2.1	SIGNALLING - MSF Yard SCR ZC	PBA-FEC PSU	4	8.53E+05	1.17	2.13E+05	4.69	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.10	0.46	0.99999946
7.9.2.2	SIGNALLING - MSF Yard SCR ZC	PBA-FEC I/O AREMA	12	4.01E+05	2.50	3.34E+04	29.95	MIL-HDBK 217F	0.25	0.05	0.01	0.10	0.00	0.10	0.51	0.99999873
7.9.2.3	SIGNALLING - MSF Yard SCR ZC	PBA-FEC SIC LED	10	4.04E+05	2.48	4.04E+04	24.76	MIL-HDBK-217F	0.25	0.05	0.01	0.10	0.00	0.10	0.51	0.99999874
7.9.3	SIGNALLING - MSF Yard SCR ZC	TERM BLOCK-M4/6.D1 RM GREY	72	1.00E+10	0.00	1.39E+08	0.01	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.9.4	SIGNALLING - MSF Yard SCR ZC	CA-AREMA 10 I/P ZC ALARMS 2300MM	2	5.00E+08	0.00	2.50E+08	0.00	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.9.5	SIGNALLING - MSF Yard SCR ZC	CA AREMA 10 I/P 2300MM	10	5.00E+08	0.00	5.00E+07	0.02	MIL-HDBK 217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.9.6	SIGNALLING - MSF Yard SCR ZC	CA-AREMA 10 O/P 2300MM	12	5.00E+08	0.00	4.17E+07	0.02	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.9.7	SIGNALLING - MSF Yard SCR ZC	CABLE ASSEMBLY-SIC I/O O/P 2300MM	10	5.00E+08	0.00	5.00E+07	0.02	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.9.8	SIGNALLING - MSF Yard SCR ZC	PBA VID	2	1.08E+07	0.09	5.38E+06	0.19		0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999996
7.9.9	SIGNALLING - MSF Yard SCR ZC	MODULE-SWITCH PSU TYP RSP120 EEC	1	5.19E+05	1.93	5.19E+05	1.93	OEM Data	0.25	0.02	0.05	0.05	0.00	0.05	0.42	0.99999919
7.9.10	SIGNALLING - MSF Yard SCR ZC	THERMOSTAT-55DEG C 120/240VAC BIMETAL NC	1	7.19E+06	0.14	7.19E+06	0.14	OEM Data	0.25	0.02	0.05	0.05	0.00	0.05	0.42	0.99999994

Ref.	System	Description	QPU	MTBF (hrs)	FR A	Total MTBF	λ x QTY	Data Source	Logistic	Access	Isolation	Remove & Replace	Alignment	Test	TOTAL	Availability
7.9.11	SIGNALLING - MSF Yard SCR ZC	CIRCUIT BREAKER-1 POLE 4A TB (ROHS)	12	2.56E+07	0.04	2.14E+06	0.47	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	0.99999998
7.9.12	SIGNALLING - MSF Yard SCR ZC	CABLE ASSEMBLY-VSC INTERFACE-3000MM	4	5.00E+08	0.00	1.25E+08	0.01	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.9.13	SIGNALLING - MSF Yard SCR ZC	TERM BLOCK-M6/8.D1 RM GRAY	52	1.00E+10	0.00	1.92E+08	0.01	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.9.14	SIGNALLING - MSF Yard SCR ZC	TERM BLOCK-M6/8P GND RM YEL/GR	4	1.00E+10	0.00	2.50E+09	0.00	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.9.15	SIGNALLING - MSF Yard SCR ZC	POWER FILTER-80DB 0.15MHZ 250VAC 10A MIL	4	1.75E+06	0.57	4.38E+05	2.28	Analogy to similar item	0.25	0.08	0.02	0.08	0.00	0.05	0.48	0.99999973
7.9.16	SIGNALLING - MSF Yard SCR ZC	FAN TRAY-19" 1U 3X105 CFM FAN 90-264VAC	4	7.50E+04	13.33	1.88E+04	53.33	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999440
7.9.17	SIGNALLING - MSF Yard SCR ZC	CABLE ASSEMBLY-ETHERNET ZC INTERNAL	12	5.00E+08	0.00	4.17E+07	0.02	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.9.18	SIGNALLING - MSF Yard SCR ZC	TERM BLOCK-M6/8.D2.1 RM GREY	50	1.00E+10	0.00	2.00E+08	0.01	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.9.19	SIGNALLING - MSF Yard SCR ZC	RELAY-DPDT 8A 24VDC DIN MOUNT	4	1.00E+07	0.10	2.50E+06	0.40	MIL-HDBK-217F	0.25	0.08	0.02	0.08	0.00	0.05	0.48	0.99999995
7.9.20	SIGNALLING - MSF Yard SCR ZC	CABLE-0.5MMSQ3CORE 300V MVB	10	5.00E+08	0.00	5.00E+07	0.02	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.10	SIGNALLING - Tremblay (TRE) ZC	RACK ASSEMBLY-ZONE CONTROLLER TRE	2	8.55E+03	117.03	4.27E+03	234.05									1.00000000
7.10.1	SIGNALLING - Tremblay (TRE) ZC	SUBRACK ASSEMBLY-ZC	1	3.90E+04	25.62	3.90E+04	25.62		0.25	0.02	0.02	0.10	0.00	0.10	0.49	0.99998745
7.10.1.1	SIGNALLING - Tremblay (TRE) ZC	PBA-EPCM	2	1.00E+05	9.98	5.01E+04	19.95	OEM Data	0.25	0.01	0.00	0.15	0.00	0.10	0.51	0.99999491
7.10.1.2	SIGNALLING - Tremblay (TRE) ZC	POWER SUPPLY MPU SUBRACK	2	5.95E+05	1.68	2.97E+05	3.36	MIL-HDBK-217F	0.25	0.01	0.00	0.05	0.00	0.10	0.41	0.99999931
7.10.1.3	SIGNALLING - Tremblay (TRE) ZC	PBA-VITAL SUPERVISON CARD (VSC)	2	1.24E+06	0.81	6.18E+05	1.62	MIL-HDBK-217F	0.25	0.01	0.00	0.05	0.00	0.10	0.41	0.99999967
7.10.1.4	SIGNALLING - Tremblay (TRE) ZC	MPU SUBRACK (EC)	1	1.47E+06	0.68	1.47E+06	0.68	MIL-HDBK-217F	0.25	0.01	0.00	0.10	0.00	0.10	0.46	0.99999969
7.10.2	SIGNALLING - Tremblay (TRE) ZC	SUBRACK ASSEMBLY-FEC 2 IO	2	2.22E+06	0.45	1.11E+06	0.90		0.25	0.02	0.01	0.20	0.00	0.10	0.58	0.99999974
7.10.2.1	SIGNALLING - Tremblay (TRE) ZC	PBA-FEC PSU	4	8.53E+05	1.17	2.13E+05	4.69	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.10	0.46	0.99999946
7.10.2.2	SIGNALLING - Tremblay (TRE) ZC	PBA-FECI/O AREMA	10	4.01E+05	2.50	4.01E+04	24.96	MIL-HDBK-217F	0.25	0.05	0.01	0.10	0.00	0.10	0.51	0.99999873
7.10.2.3	SIGNALLING - Tremblay (TRE) ZC	PBA-FEC SIC LED	12	4.04E+05	2.48	3.37E+04	29.71	MIL-HDBK-217F	0.25	0.05	0.01	0.10	0.00	0.10	0.51	0.99999874
7.10.3	SIGNALLING - Tremblay (TRE) ZC	TERM BLOCK-M4/6.D1 RM GREY	72	1.00E+10	0.00	1.39E+08	0.01	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.10.4	SIGNALLING - Tremblay (TRE) ZC	CA-AREMA 10 I/P ZC ALARMS 2300MM	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.10.5	SIGNALLING - Tremblay (TRE) ZC	CA-AREMA 10 I/P 2300MM	9	5.00E+08	0.00	5.56E+07	0.02	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.10.6	SIGNALLING - Tremblay (TRE) ZC	CA-AREMA 10 O/P 2300MM	10	5.00E+08	0.00	5.00E+07	0.02	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.10.7	SIGNALLING - Tremblay (TRE) ZC	CABLE ASSEMBLY-SIC I/O O/P 2300MM	12	5.00E+08	0.00	4.17E+07	0.02	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.10.8	SIGNALLING - Tremblay (TRE) ZC	PBA-VID	1	1.08E+07	0.09	1.08E+07	0.09		0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999996
7.10.9	SIGNALLING - Tremblay (TRE) ZC	MODULE-SWITCH PSU TYP RSP120 EEC	1	5.19E+05	1.93	5.19E+05	1.93	OEM Data	0.25	0.02	0.05	0.05	0.00	0.05	0.42	0.99999919
7.10.10	SIGNALLING - Tremblay (TRE) ZC	THERMOSTAT-55DEG C 120/240VAC BIMETAL NC	1	7.19E+06	0.14	7.19E+06	0.14	Analogy to similar item	0.25	0.02	0.05	0.05	0.00	0.05	0.42	0.99999994
7.10.11	SIGNALLING - Tremblay (TRE) ZC	CIRCUIT BREAKER-1 POLE 4A TB (ROHS)	12	2.56E+07	0.04	2.14E+06	0.47	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	0.99999998
7.10.12	SIGNALLING - Tremblay (TRE) ZC	CABLE ASSEMBLY-VSC INTERFACE-3000MM	2	5.00E+08	0.00	2.50E+08	0.00	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.10.13	SIGNALLING - Tremblay (TRE) ZC	TERM BLOCK-M6/8.D1 RM GRAY	52	1.00E+10	0.00	1.92E+08	0.01	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.10.14	SIGNALLING - Tremblay (TRE) ZC	TERM BLOCK-M6/8P GND RM YEL/GR	4	1.00E+10	0.00	2.50E+09	0.00	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.10.15	SIGNALLING - Tremblay (TRE) ZC	POWER FILTER-80DB 0.15MHZ 250VAC 10A MIL	2	1.75E+06	0.57	8.76E+05	1.14	Analogy to similar item	0.25	0.08	0.02	0.08	0.00	0.05	0.48	0.99999973
7.10.16	SIGNALLING - Tremblay (TRE) ZC	FAN TRAY-19" 1U 3X105 CFM FAN 90-264VAC	2	7.50E+04	13.33	3.75E+04	26.67	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999440
7.10.17	SIGNALLING - Tremblay (TRE) ZC	CABLE ASSEMBLY-ETHERNET ZC INTERNAL	6	5.00E+07	0.02	8.33E+06	0.12	MIL-HDBK-217F	0.25	0.10	0.02	0.20	0.00	0.05	0.62	0.99999999
7.10.18	SIGNALLING - Tremblay (TRE) ZC	TERM BLOCK-M6/8.D2.1 RM GREY	50	1.00E+10	0.00	2.00E+08	0.01	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.10.19	SIGNALLING - Tremblay (TRE) ZC	RELAY-DPDT 8A 24VDC DIN MOUNT	4	1.00E+07	0.10	2.50E+06	0.40	MIL-HDBK-217F	0.25	0.08	0.02	0.08	0.00	0.05	0.48	0.99999995
7.10.20	SIGNALLING - Tremblay (TRE) ZC	CABLE-0.5MMSQ3CORE 300V MVB	10	5.00E+08	0.00	5.00E+07	0.02	MIL HDBK 217F	0.25	0.10	0.02	0.20	0.00	0.05	0.62	1.00000000
7.10.21	SIGNALLING - Tremblay (TRE) ZC	PBA-VID	1	1.08E+07	0.09	1.08E+07	0.09		0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999996
7.11	SIGNALLING - CTF	ASSY-CTF 380VAC (OLRT)	2	3.85E+06	0.26	1.92E+06	0.52									1.00000000
7.11.1	SIGNALLING - CTF	TERMINAL BLOCK -M4/6.SNBT.4A	200	1.00E+10	0.00	5.00E+07	0.02	Demonstrated field data	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.11.2	SIGNALLING - CTF	SURGE PROTECTOR-400VAC 4POLE TYPE 2 DIN	24	1.00E+08	0.01	4.17E+06	0.24	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.11.3	SIGNALLING - CTF	ASSY-CTF 380VAC/220VAC (OLRT)	3	1.61E+06	0.62	5.36E+05	1.87									1.00000000
7.11.4	SIGNALLING - CTF	TERMINAL BLOCK- M4/6.SNBT.4A	224	1.00E+10	0.00	4.46E+07	0.02	Demonstrated field data	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.11.5	SIGNALLING - CTF	SURGE PROTECTOR-400VAC 4POLE TYPE 2 DIN	12	1.00E+08	0.01	8.33E+06	0.12	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.11.6	SIGNALLING - CTF	SURGE PROTECTOR-230VAC 40KA TYPE 2L+ND	48	1.00E+08	0.01	2.08E+06	0.48	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.11.7	SIGNALLING - CTF	ASSY-CTF 220VAC/110VAC (OLRT)	2	1.06E+06	0.95	5.29E+05	1.89									1.00000000
7.11.8	SIGNALLING - CTF	TERMINAL BLOCK- M4/6.SNBT.4A	256	1.00E+10	0.00	3.91E+07	0.03	Demonstrated field data	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.11.9	SIGNALLING - CTF	SURGE PROTECTOR-120VAC 40KA TYPE 2L+ND	44	1.00E+08	0.01	2.27E+06	0.44	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.11.10	SIGNALLING - CTF	SURGE PROTECTOR-230VAC 40KA TYPE 2L+ND	48	1.00E+08	0.01	2.08E+06	0.48	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000

Ref.	System	Description	QPU	MTBF (hrs)	FR A	Total MTBF	A x QTY	Data Source	Logistic	Access	Isolation	Remove & Replace	Alignment	Test	TOTAL	Availability
7.11.11	SIGNALLING - CTF	ASSY-CTF CTF 110VAC/12VDC (OLRT)	4	6.05E+05	1.65	1.51E+05	6.61									1.00000000
7.11.12	SIGNALLING - CTF	TERMINAL BLOCK- M4/6.SNBT.4A	132	1.00E+10	0.00	7.58E+07	0.01	Demonstrated field data	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.11.13	SIGNALLING - CTF	SURGE PROTECTOR-120VAC 40KA TYPE 2 L+N D	44	1.00E+08	0.01	2.27E+06	0.44	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.11.14	SIGNALLING - CTF	SURGE PROTECTOR-12V 2.1A 1PAIR PLUG DIN	120	1.00E+08	0.01	8.33E+05	1.20	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.11.15	SIGNALLING - CTF	ASSY-CTF 12VDC (OLRT)	1	7.01E+05	1.43	7.01E+05	1.43									1.00000000
7.11.16	SIGNALLING - CTF	TERM BLOCK-4P 1-LVL 6.2MM KNIFE DISCON	66	1.00E+10	0.00	1.52E+08	0.01	Demonstrated field data	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.11.17	SIGNALLING - CTF	SURGE PROTECTOR-12V 2.1A 1PAIR PLUG DIN	120	1.00E+08	0.01	8.33E+05	1.20	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.11.18	SIGNALLING - CTF	SURGE PROTECTOR-12VDC 10KA TYPE 2 DIN	22	1.00E+08	0.01	4.55E+06	0.22	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.12	SIGNALLING - Wayside Equipment	SIGNAL LIGHT-LED TYPE L MK2 GRN/WHT/RED	26	4.72E+05	2.12	1.81E+04	55.12	Analogy to similar item	0.25	0.02	0.02	0.20	0.00	0.05	0.54	0.99999886
7.12.1	SIGNALLING - Wayside Equipment	SIGNAL LIGHT-LED TYPE U2L GRN/WHT/RED	4	4.72E+05	2.12	1.18E+05	8.48	Analogy to similar item	0.25	0.02	0.02	0.20	0.00	0.05	0.54	0.99999886
7.12.2	SIGNALLING - Wayside Equipment	SIGNAL LIGHT-LED TYPE L MK2 WHITE/RED	17	4.72E+05	2.12	2.77E+04	36.04	Analogy to similar item	0.25	0.02	0.02	0.20	0.00	0.05	0.54	0.99999886
7.12.3	SIGNALLING - Wayside Equipment	SIGNAL LIGHT-LED TYPE L MK2 GREEN/RED	8	4.72E+05	2.12	5.90E+04	16.96	Analogy to similar item	0.25	0.02	0.02	0.10	0.00	0.05	0.44	0.99999907
7.12.4	SIGNALLING - Wayside Equipment	ASSY-SWITCH MACHINE POINT (OLRT)	60	1.46E+06	0.68	2.44E+04	40.98	OEM Data	0.25	0.01	0.00	0.65	0.00	0.05	0.96	0.99999934
7.12.5	SIGNALLING - Wayside Equipment	TAG- RF BEAM HALF FRAME AREMA TRACKBED	474	3.95E+06	0.25	8.34E+03	119.92	OEM Data	0.25	0.01	0.05	0.03	0.01	0.01	0.36	0.99999991
7.13	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 24)	RA-ELECTRONIC POINT CONTROLLER (TYPE 24)	4	1.70E+04	58.85	4.25E+03	235.39									1.00000000
7.13.1	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 24)	SA-ETHERNET TO CAN CONVERTER	1	6.93E+05	1.44	6.93E+05	1.44		0.25	0.02	0.01	0.20	0.00	0.10	0.58	0.99999916
7.13.1.1	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 24)	PBA-MPU/PSU 72V I/P	2	1.72E+06	0.58	8.61E+05	1.16	MIL-HDBK-217F	0.25	0.01	0.00	0.15	0.00	0.10	0.51	0.99999970
7.13.1.2	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 24)	PBA-ETH/CAN CNVRTR	2	1.00E+07	0.10	5.00E+06	0.20	MIL-HDBK-217F	0.25	0.01	0.00	0.05	0.00	0.10	0.41	0.99999996
7.13.1.3	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 24)	PBA-MPU/CAN MOTHERBOARD	1	1.23E+07	0.08	1.23E+07	0.08	MIL-HDBK-217F	0.25	0.01	0.00	0.10	0.00	0.10	0.46	0.99999996
7.13.2	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 24)	FAN TRAY-19" RM 3FAN 230V FAILURE ALARM	2	6.00E+04	16.67	3.00E+04	33.33	MIL-HDBK-217F	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999217
7.13.3	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 24)	CABLE ASSEMBLY-ECAN TO POINT CONTROLLER	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.13.4	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 24)	CAN-Cabel 1.5 M	2	5.00E+08	0.00	2.50E+08	0.00	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.13.5	SIGNALLING - RA ELECTRONIC POINT CONTROLLER (TYPE 24)	FILTER-EMI	1	4.17E+06	0.24	4.17E+06	0.24	MIL-HDBK-217F	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999989
7.13.6	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 24)	CORD PWR AC 10A/250V C13 C14 2.5M	2	1.00E+09	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.02	0.02	0.05	0.00	0.05	0.39	1.00000000
7.13.7	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 24)	EMPTY SUB RACK/ INTERFACE BOARDS	2	1.23E+07	0.08	6.17E+06	0.16	MIL-HDBK-217F	0.25	0.02	0.01	0.20	0.00	0.10	0.58	0.99999995
7.13.8	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 24)	POINT CONTROLLER TAS FEC 2.3	24	1.19E+06	0.84	4.97E+04	20.14	MIL-HDBK-217F	0.25	0.05	0.01	0.10	0.00	0.10	0.51	0.99999957
7.13.9	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 24)	CABLE ASSEMBLY-POWER TO ECAN	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.13.10	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 24)	FERRITE-EMI CBL CLAMP 0.506" 25-300MHZ	2	1.00E+09	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.02	0.02	0.05	0.00	0.05	0.39	1.00000000
7.13.11	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 24)	FERRITE-EMI CLAMP .760" DIA	20	1.00E+09	0.00	5.00E+07	0.02	MIL-HDBK-217F	0.25	0.02	0.02	0.05	0.00	0.05	0.39	1.00000000
7.13.12	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 24)	PSU / INTERFACE BOARDS 60VDC	4	1.14E+06	0.88	2.86E+05	3.50	MIL-HDBK-217F	0.25	0.05	0.01	0.10	0.00	0.10	0.51	0.99999955
7.14	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 36)	RA-ELECTRONIC POINT CONTROLLER (TYPE 36)	1	1.42E+04	70.67	1.42E+04	70.67									1.00000000
7.14.1	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 36)	SA-ETHERNET TO CAN CONVERTER	1	6.93E+05	1.44	6.93E+05	1.44		0.25	0.02	0.01	0.20	0.00	0.10	0.58	0.99999916

Ref.	System	Description	QPU	MTBF (hrs)	FR A	Total MTBF	λ x QTY	Data Source	Logistic	Access	Isolation	Remove & Replace	Alignment	Test	TOTAL	Availability
7.14.1.1	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 36)	PBA-MPU/PSU 72V I/P	2	1.72E+06	0.58	8.61E+05	1.16	MIL-HDBK-217F	0.25	0.01	0.00	0.15	0.00	0.10	0.51	0.99999970
7.14.1.2	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 36)	PBA-ETH/CAN CNVRTR	2	1.00E+07	0.10	5.00E+06	0.20	MIL-HDBK-217F	0.25	0.01	0.00	0.05	0.00	0.10	0.41	0.99999996
7.14.1.3	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 36)	PBA-MPU/CAN MOTHERBOARD	1	1.23E+07	0.08	1.23E+07	0.08	MIL-HDBK-217F	0.25	0.01	0.00	0.10	0.00	0.10	0.46	0.99999996
7.14.2	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 36)	FAN TRAY-19" RM 3FAN 230V FAILURE ALARM	2	6.00E+04	16.67	3.00E+04	33.33	MIL-HDBK-217F	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999217
7.14.3	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 36)	CABLE ASSEMBLY-ECAN TO POINT CONTROLLER	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.14.4	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 36)	CAN-Cabel 1.5 M	2	5.00E+08	0.00	2.50E+08	0.00	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.14.5	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 36)	FILTER-EMI	1	4.17E+06	0.24	4.17E+06	0.24	MIL-HDBK-217F	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999989
7.14.6	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 36)	CORD-PWR AC 10A/250V C13 C14 2.5M	2	1.00E+09	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.02	0.02	0.05	0.00	0.05	0.39	1.00000000
7.14.7	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 36)	EMPTY SUB RACK/ INTERFACE BOARDS	2	1.23E+07	0.08	6.17E+06	0.16	MIL-HDBK-217F	0.25	0.02	0.01	0.20	0.00	0.10	0.58	0.99999995
7.14.8	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 36)	POINT CONTROLLER TAS FEC 2.3	36	1.19E+06	0.84	3.31E+04	30.20	MIL HDBK 217F	0.25	0.05	0.01	0.10	0.00	0.10	0.51	0.99999957
7.14.9	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 36)	CABLE ASSEMBLY-POWER TO ECAN	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.14.10	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 36)	FERRITE-EMI CBL CLAMP 0.506" 25-300MHZ	2	1.00E+09	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.02	0.02	0.05	0.00	0.05	0.39	1.00000000
7.14.11	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 36)	FERRITE-EMI CLAMP .760" DIA	20	1.00E+09	0.00	5.00E+07	0.02	MIL-HDBK-217F	0.25	0.02	0.02	0.05	0.00	0.05	0.39	1.00000000
7.14.12	SIGNALLING - RA-ELECTRONIC POINT CONTROLLER (TYPE 36)	PSU / INTERFACE BOARDS 60VDC	6	1.14E+06	0.88	1.90E+05	5.25	MIL-HDBK-217F	0.25	0.05	0.01	0.10	0.00	0.10	0.51	0.99999955
7.15	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	RACK ASSY-POINT POWER DISTRIBUTION MSF	5	2.54E+05	3.94	5.08E+04	19.69									1.00000000
7.15.1	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	ASSEMBLY-POWER DISTRIBUTION	1	8.70E+06	0.12	8.70E+06	0.12		0.25	0.02	0.02	0.10	0.00	0.10	0.49	0.99999994
7.15.1.1	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	CIRCUIT BREAKER- 1P 6A 240V	8	1.00E+08	0.01	1.25E+07	0.08	MIL-HDBK-217F	0.25	0.01	0.00	0.10	0.00	0.10	0.46	1.00000000
7.15.1.2	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	CIRCUIT BREAKER-1 POLE	2	1.00E+08	0.01	5.00E+07	0.02	MIL-HDBK-217F	0.25	0.01	0.00	0.10	0.00	0.10	0.46	1.00000000
7.15.1.3	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	CIRCUIT BREAKER - 3 POLE	1	1.00E+08	0.01	1.00E+08	0.01	MIL-HDBK-217F	0.25	0.01	0.00	0.10	0.00	0.10	0.46	1.00000000
7.15.1.4	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	TERM BLOCK-M4/6.D1 RM GREY	50	1.00E+10	0.00	2.00E+08	0.01	MIL-HDBK-217F	0.25	0.01	0.00	0.10	0.00	0.10	0.46	1.00000000
7.15.1.5	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	RES WW TYPE CW 4K7 5% 7W (ROHS)	1	1.00E+09	0.00	1.00E+09	0.00	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.15.2	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	ASSEMBLY-POWER SUPPLIES	1	7.72E+05	1.30	7.72E+05	1.30	MIL-HDBK-217F	0.25	0.02	0.02	0.10	0.00	0.10	0.49	0.99999937
7.15.2.1	SIGNALLING - RACK ASSY POINT POWER DISTRIBUTION MSF	CNVRTR-AC/DC 56.5V O/P 500W	2	4.05E+06	0.25	2.02E+06	0.49	Analogy to similar item	0.25	0.01	0.00	0.10	0.00	0.10	0.46	0.99999989
7.15.2.2	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	TERM BLOCK-M4/6 RM GREY	8	1.00E+10	0.00	1.25E+09	0.00	MIL-HDBK-217F	0.25	0.01	0.00	0.10	0.00	0.10	0.46	1.00000000
7.15.2.3	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	SOCKET-RELAY TYPE G2R SCREW TERM	3	1.00E+10	0.00	3.33E+09	0.00	MIL-HDBK-217F	0.25	0.01	0.00	0.10	0.00	0.10	0.46	1.00000000

Ref.	System	Description	QPU	MTBF (hrs)	FR λ	Total MTBF	λ x QTY	Data Source	Logistic	Access	Isolation	Remove & Replace	Alignment	Test	TOTAL	Availability
7.15.2.4	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	RELAY-DPDT 5A 24VDC 1113OHM (ROHS)	3	5.00E+06	0.20	1.67E+06	0.60	MIL-HDBK-217F	0.25	0.01	0.00	0.10	0.00	0.10	0.46	0.99999991
7.15.2.5	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	RELAY-DELAY TIMER SPDT DIN MOUNT	1	5.00E+06	0.20	5.00E+06	0.20	MIL-HDBK-217F	0.25	0.01	0.00	0.10	0.00	0.10	0.46	0.99999991
7.15.3	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	RELAY-SAFETY TYPE QN1 8F8B S0V	2	5.00E+06	0.20	2.50E+06	0.40	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	0.99999990
7.15.4	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	SOCKET-RELAY TYPE QN1 8F8B	2	1.00E+09	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.15.5	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	RELAY-TYPE NS1 4F4B 24V	2	5.00E+06	0.20	2.50E+06	0.40	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	0.99999990
7.15.6	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	SOCKET-RELAY TYPE NS1 4F4B	4	1.00E+09	0.00	2.50E+08	0.00	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.15.7	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	TERM BLOCK-M4/6P GND RM YEL/GR	4	1.00E+10	0.00	2.50E+09	0.00	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.15.8	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	CODING PLUG-RELAY TYPE NS1	6	1.00E+09	0.00	1.67E+08	0.01	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.15.9	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	ASSEMBLY-GROUND LEAKAGE MONITOR	1	5.83E+05	1.72	5.83E+05	1.72	MIL-HDBK-217F	0.25	0.02	0.02	0.10	0.00	0.10	0.49	0.99999916
7.15.9.1	SIGNALLING RACK ASSY POINT POWER DISTRIBUTION MSF	CNVRTR-AC/DC 56.SV O/P S00W	2	4.05E+06	0.25	2.02E+06	0.49	OEM Data	0.25	0.01	0.00	0.15	0.00	0.10	0.51	0.99999987
7.15.9.2	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	CON-DIN 41612 H 15P FML Q DIS	3	1.00E+08	0.01	3.33E+07	0.03	MIL-HDBK-217F	0.25	0.01	0.00	0.10	0.00	0.10	0.46	1.00000000
7.15.9.3	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	CNVRTR-AC/DC 48V O/P 150W	1	2.50E+06	0.40	2.50E+06	0.40	OEM Data	0.25	0.01	0.00	0.10	0.00	0.10	0.46	0.99999982
7.15.9.4	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	MODULE-EARTH LEAKAGE MONITOR 300DC/250AC	2	1.47E+07	0.07	7.35E+06	0.14	Demonstrated field data	0.25	0.01	0.00	0.10	0.00	0.10	0.46	0.99999997
7.15.9.5	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	METER-INSULATION RESISTANCE	1	5.52E+06	0.18	5.52E+06	0.18	Analogy to similar item	0.25	0.01	0.00	0.10	0.00	0.10	0.46	0.99999992
7.15.9.6	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	TERM BLOCK-M4/6.D1 RM GREY	20	1.00E+10	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.01	0.00	0.10	0.00	0.10	0.46	1.00000000
7.15.9.7	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	DIODE-RCTR 400V 1A 1N4004	4	1.00E+08	0.01	2.50E+07	0.04	MIL-HDBK-217F	0.25	0.01	0.00	0.10	0.00	0.10	0.46	1.00000000
7.15.9.8	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	TERM BLOCK-EBS BODY RM GREY	2	1.00E+10	0.00	5.00E+09	0.00	MIL-HDBK-217F	0.25	0.01	0.00	0.10	0.00	0.10	0.46	1.00000000
7.15.9.9	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	TERM BLOCK-M4/6.D2.1 RM GREY	40	1.00E+10	0.00	2.50E+08	0.00	MIL-HDBK-217F	0.25	0.01	0.00	0.10	0.00	0.10	0.46	1.00000000
7.15.9.10	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	RELAY-24V/10 DPDT W/IND.RAIL	2	5.00E+06	0.20	2.50E+06	0.40	MIL-HDBK-217F	0.25	0.01	0.00	0.10	0.00	0.10	0.46	0.99999991
7.15.9.11	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	SOCKET-8PIN OCTAL DIN RAIL MNT	2	2.50E+08	0.00	1.25E+08	0.01	MIL-HDBK-217F	0.25	0.01	0.00	0.10	0.00	0.10	0.46	1.00000000
7.15.9.12	SIGNALLING RACK ASSY-POINT POWER DISTRIBUTION MSF	FUSE TYPE GMA 1A 250V SMMX20MM	2	1.00E+08	0.01	5.00E+07	0.02	MIL-HDBK-217F	0.25	0.01	0.00	0.10	0.00	0.10	0.46	1.00000000
7.15.9.13	SIGNALLING - RACK ASSY-POINT POWER DISTRIBUTION MSF	TERM BLOCK-M4/8.SN1 RM FUSE	2	1.00E+10	0.00	5.00E+09	0.00	MIL-HDBK-217F	0.25	0.01	0.00	0.10	0.00	0.10	0.46	1.00000000
7.16	SIGNALLING RELAY RACK ASSEMBLY	RELAY RACK ASSEMBLY Zone Specific	1	1.34E+04	74.86	1.34E+04	74.86									1.00000000
7.16.1	SIGNALLING - RELAY RACK ASSEMBLY	RACK ASSY-RELAY ZC1-RR1	1	3.92E+05	2.55	3.92E+05	2.55	MIL-HDBK-217F								1.00000000
7.16.2	SIGNALLING - RELAY RACK ASSEMBLY	RACK ASSY-RELAY ZC1-RR2	1	1.44E+05	6.93	1.44E+05	6.93	MIL-HDBK-217F								1.00000000
7.16.3	SIGNALLING RELAY RACK ASSEMBLY	RACK ASSY RELAY ZC2 RR1	1	4.88E+05	2.05	4.88E+05	2.05	MIL-HDBK-217F								1.00000000
7.16.4	SIGNALLING - RELAY RACK ASSEMBLY	RACK ASSY-RELAY ZC2-RR2	1	1.29E+05	7.75	1.29E+05	7.75	MIL-HDBK-217F								1.00000000
7.16.5	SIGNALLING - RELAY RACK ASSEMBLY	RACK ASSY-RELAY ZC2-RR3	1	1.98E+05	5.06	1.98E+05	5.06	MIL-HDBK-217F								1.00000000
7.16.6	SIGNALLING RELAY RACK ASSEMBLY	RACK ASSY RELAY ZC2 RR4	1	2.23E+05	4.49	2.23E+05	4.49	MIL-HDBK-217F								1.00000000

Ref.	System	Description	QPU	MTBF (hrs)	FR λ	Total MTBF	λ x QTY	Data Source	Logistic	Access	Isolation	Remove & Replace	Alignment	Test	TOTAL	Availability
7.16.7	SIGNALLING - RELAY RACK ASSEMBLY	RACK ASSY-RELAY ZC3-RR1	1	4.88E+05	2.05	4.88E+05	2.05	MIL-HDBK-217F								1.00000000
7.16.8	SIGNALLING - RELAY RACK ASSEMBLY	RACK ASSY-RELAY ZC3-RR2	1	1.29E+05	7.75	1.29E+05	7.75	MIL-HDBK-217F								1.00000000
7.16.9	SIGNALLING - RELAY RACK ASSEMBLY	RACK ASSY-RELAY ZC3-RR3	1	1.39E+05	7.17	1.39E+05	7.17	MIL-HDBK-217F								1.00000000
7.16.10	SIGNALLING - RELAY RACK ASSEMBLY	RACK ASSY-RELAY ZC3-RR4	1	2.71E+05	3.69	2.71E+0S	3.69	MIL-HDBK-217F								1.00000000
7.16.11	SIGNALLING - RELAY RACK ASSEMBLY	RACK ASSY-RELAY ZC4-RR1	1	4.88E+05	2.05	4.88E+05	2.05	MIL-HDBK-217F								1.00000000
7.16.12	SIGNALLING - RELAY RACK ASSEMBLY	RACK ASSY-RELAY ZC4-RR2	1	1.63E+05	6.12	1.63E+05	6.12	MIL-HDBK-217F								1.00000000
7.16.13	SIGNALLING - RELAY RACK ASSEMBLY	RACK ASSY-RELAY ZCS-RR1	1	3.92E+0S	2.55	3.92E+0S	2.55	MIL-HDBK-217F								1.00000000
7.16.14.1	SIGNALLING - RELAY RACK ASSEMBLY	TERM BLOCK-M4/6.SNB RM GREY-ORG (ROHS)	155	1.00E+10	0.00	6.45E+07	0.02	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.16.14.2	SIGNALLING - RELAY RACK ASSEMBLY	TERMINAL BLOCK-M4/8.SF RM GREY	50	1.00E+10	0.00	2.00E+08	0.01	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.16.14.3	SIGNALLING - RELAY RACK ASSEMBLY	FUSE LINK-1A 250V SX20MM	50	1.00E+08	0.01	2.00E+06	0.50	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.16.14.4	SIGNALLING - RELAY RACK ASSEMBLY	RELAY-VITAL TYPE B1 0.0157A 6FB 30-220V	4	5.00E+06	0.20	1.25E+06	0.80	OEM Data	0.25	0.10	0.02	0.10	0.00	0.05	0.52	0.99999990
7.16.14.5	SIGNALLING - RELAY RACK ASSEMBLY	RELAY-TYPE ST 2FB-4F-2B 4A 30V	6	5.00E+06	0.20	8.33E+0S	1.20	OEM Data	0.25	0.10	0.02	0.10	0.00	0.05	0.52	0.99999990
7.16.14.6	SIGNALLING - RELAY RACK ASSEMBLY	PLUGBOARD-TYPE B1 RELAY 16-20AWG CRIMP	10	3.33E+08	0.00	3.33E+07	0.03	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.16.15	SIGNALLING - RELAY RACK ASSEMBLY	RACK ASSY-RELAY ZCS-RR2	1	1.17E+05	8.56	1.17E+05	8.56									1.00000000
7.16.15.1	SIGNALLING - RELAY RACK ASSEMBLY	TERM BLOCK-M4/6.SNB RM GREY-ORG (ROHS)	268	1.00E+10	0.00	3.73E+07	0.03	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.16.15.2	SIGNALLING - RELAY RACK ASSEMBLY	TERMINAL BLOCK-M4/8.SF RM GREY	80	1.00E+10	0.00	1.25E+08	0.01	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.16.15.3	SIGNALLING - RELAY RACK ASSEMBLY	FUSE LINK-1A 250V SX20MM	80	1.00E+08	0.01	1.25E+06	0.80	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.16.15.4	SIGNALLING - RELAY RACK ASSEMBLY	CON-INSERT 42 PIN HAN DD FML	20	4.76E+07	0.02	2.38E+06	0.42	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	0.99999999
7.16.15.5	SIGNALLING - RELAY RACK ASSEMBLY	RELAY-VITAL TYPE B1 4FB-2F-1B 7.5VDC	36	5.00E+06	0.20	1.39E+05	7.20	OEM Data	0.25	0.10	0.02	0.10	0.00	0.05	0.52	0.99999990
7.16.15.6	SIGNALLING - RELAY RACK ASSEMBLY	PLUGBOARD-TYPE B1 RELAY 16-20AWG CRIMP	36	3.33E+08	0.00	9.26E+06	0.11	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.16.16	SIGNALLING - RELAY RACK ASSEMBLY	RACK ASSY-RELAY ZCS-RR3	1	1.64E+05	6.08	1.64E+0S	6.08									1.00000000
7.16.16.1	SIGNALLING - RELAY RACK ASSEMBLY	TERM BLOCK-M4/6.SNB RM GREY-ORG (ROHS)	276	1.00E+10	0.00	3.62E+07	0.03	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.16.16.2	SIGNALLING - RELAY RACK ASSEMBLY	TERMINAL BLOCK-M4/8.SF RM GREY	50	1.00E+10	0.00	2.00E+08	0.01	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.16.16.3	SIGNALLING - RELAY RACK ASSEMBLY	FUSE LINK-1A 250V SX20MM	50	1.00E+08	0.01	2.00E+06	0.50	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.16.16.4	SIGNALLING - RELAY RACK ASSEMBLY	CON-INSERT 42 PIN HAN DD FML	14	4.76E+07	0.02	3.40E+06	0.29	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	0.99999999
7.16.16.5	SIGNALLING - RELAY RACK ASSEMBLY	RELAY-VITAL TYPE B1 4FB-2F-1B 7.SVDC	12	5.00E+06	0.20	4.17E+0S	2.40	OEM Data	0.25	0.10	0.02	0.10	0.00	0.05	0.52	0.99999990
7.16.16.6	SIGNALLING - RELAY RACK ASSEMBLY	RELAY-VITAL TYPE B1 0.0157A 6FB 30-220V	6	5.00E+06	0.20	8.33E+0S	1.20	OEM Data	0.25	0.10	0.02	0.10	0.00	0.05	0.52	0.99999990
7.16.16.7	SIGNALLING - RELAY RACK ASSEMBLY	PLUGBOARD-TYPE B1 RELAY 16-20AWG CRIMP	18	3.33E+08	0.00	1.85E+07	0.05	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	1.00000000
7.16.16.8	SIGNALLING - RELAY RACK ASSEMBLY	RELAY-DPDT 8A 12VDC DIN MOUNT	10	1.00E+07	0.10	1.00E+06	1.00	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	0.99999995
7.16.16.9	SIGNALLING - RELAY RACK ASSEMBLY	RELAY-DPDT 8A 120VAC DIN MOUNT	6	1.00E+07	0.10	1.67E+06	0.60	MIL-HDBK-217F	0.25	0.10	0.02	0.10	0.00	0.05	0.52	0.99999995
7.17	SIGNALLING - DCS TYPE 1A	RACK ASSEMBLY-DCS TYPE 1A-GENERIC	1	6.25E+03	159.97	6.25E+03	159.97									1.00000000
7.17.1	SIGNALLING - DCS TYPE 1A	PWR BAR-30-C13 6-C19 OUTLETS 32A VERT	2	2.56E+07	0.04	1.28E+07	0.08	OEM Data	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999998
7.17.2	SIGNALLING - DCS TYPE 1A	PATCH PANEL-48 PORT RJ45 CATSE SHIELD	1	3.16E+0S	3.16	3.16E+0S	3.16	OEM Data	0.25	0.05	0.02	0.20	0.00	0.05	0.57	0.99999820
7.17.3	SIGNALLING - DCS TYPE 1A	PANEL-FIBER COUPLER SM 6 SC DUPLEX	6	2.13E+0S	4.70	3.5SE+04	28.20	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999803
7.17.4	SIGNALLING - DCS TYPE 1A	CABLE-PATCH CATSE UTP GRY 2M LSZH	36	5.00E+08	0.00	1.39E+07	0.07	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.17.5	SIGNALLING - DCS TYPE 1A	CORD-PWR AC 10A/250V C13 C14 2.SM	10	1.00E+09	0.00	1.00E+08	0.01	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.17.6	SIGNALLING - DCS TYPE 1A	PATCH PANEL-24 PORT RJ45 CATSE SHIELD	1	6.32E+0S	1.58	6.32E+05	1.58	OEM Data	0.25	0.05	0.02	0.15	0.00	0.05	0.52	0.99999918
7.17.7	SIGNALLING - DCS TYPE 1A	PSU-12VDC SA I/P 85-264VAC 45-65HZ DIN	2	1.85E+06	0.54	9.26E+0S	1.08	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999978
7.17.8	SIGNALLING - DCS TYPE 1A	PANEL-PATCH FIBER 4-PORT 1U	2	2.23E+06	0.45	1.12E+06	0.90	OEM Data	0.25	0.05	0.01	0.10	0.00	0.05	0.46	0.99999979
7.17.9	SIGNALLING - DCS TYPE 1A	CABLE ASSEMBLY-SDR POWER 2M	4	1.00E+09	0.00	2.S0E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.17.10	SIGNALLING - DCS TYPE 1A	MODULE-ETHERNET SW16+4 PORT MSP30	2	2.12E+05	4.72	1.06E+0S	9.43	OEM Data	0.25	0.05	0.02	0.15	0.00	0.05	0.52	0.99999755
7.17.11	SIGNALLING - DCS TYPE 1A	MODULE-ETHERNET SW L2E 10 PORT MS30	1	4.04E+0S	2.48	4.04E+05	2.48	OEM Data	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999884
7.17.12	SIGNALLING - DCS TYPE 1A	MODULE-MEDIA SW SGL MM2-4TX1	10	3.79E+06	0.26	3.79E+0S	2.64	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999989
7.17.13	SIGNALLING - DCS TYPE 1A	MODULE-ETHERNET SW 9 PORT MANAGED	2	4.26E+05	2.35	2.13E+0S	4.70	OEM Data	0.25	0.05	0.01	0.10	0.00	0.05	0.46	0.99999892
7.17.14	SIGNALLING - DCS TYPE 1A	MODULE-ETHERNET SW L2E 18 PORT MS30	2	2.85E+0S	3.51	1.42E+0S	7.02	OEM Data	0.25	0.05	0.02	0.15	0.00	0.05	0.52	0.99999817
7.17.15	SIGNALLING - DCS TYPE 1A	CBTC RADIO 1964500-901	4	6.58E+05	1.52	1.64E+0S	6.08	OEM Data	0.25	0.05	0.01	0.10	0.00	0.05	0.46	0.99999930
7.17.16	SIGNALLING - DCS TYPE 1A	FAN TRAY-19" 1U 3X105 CFM FAN 90-264VAC	2	7.S0E+04	13.33	3.75E+04	26.67	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999453
7.17.17	SIGNALLING - DCS TYPE 1A	TRANSCVR-SM LC DUP SFP100 TX/RX1310 30KM	6	7.33E+05	1.37	1.22E+0S	8.19	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999944
7.17.18	SIGNALLING - DCS TYPE 1A	MODULE-MEDIA SW DUAL RJ45/SM	4	5.69E+0S	1.76	1.42E+0S	7.04	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999928
7.17.19	SIGNALLING - DCS TYPE 1A	TRANSCVR-SM LC DUP SFP 1000BASE-LHX 30KM	2	2.82E+05	3.55	1.41E+0S	7.10	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999855

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7.17.20	SIGNALLING - DCS TYPE 1A	MODULE-MEDIA SW MM4-2TX/SFP	3	1.43E+06	0.70	4.76E+05	2.10	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999971
7.17.21	SIGNALLING - DCS TYPE 1A	TRANSCVR-SM LC DUP SFP 1000BASE-LX 10KM	2	2.82E+05	3.55	1.41E+05	7.10	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999855
7.17.22	SIGNALLING - DCS TYPE 1A	MODULE-MEDIA SW M-SFP-LX/LC	6	3.79E+06	0.26	6.31E+05	1.58	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999989
7.17.23	SIGNALLING - DCS TYPE 1A	MODULE-SWITCH PSU TYP RSP120 EEC	6	5.19E+05	1.93	8.66E+04	11.55	OEM Data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999910
7.17.24	SIGNALLING - DCS TYPE 1A	CABLE-PATCH CATSE UTP GRY 3M LSZH	34	5.00E+08	0.00	1.47E+07	0.07	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.10	0.47	1.00000000
7.17.25	SIGNALLING - DCS TYPE 1A	PANEL-FIBRE COUPLER 6 SC DUP 4.3"X1.38"	2	2.13E+05	4.70	1.06E+05	9.40	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999803
7.17.26	SIGNALLING - DCS TYPE 1A	TRANSCVR-MM LC DUP SFP 1000BASE-SX 2KM	8	6.85E+05	1.46	8.56E+04	11.68	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999940
7.17.27	SIGNALLING - DCS TYPE 1A	CABLE-PATCH CORD LC/SC MM DUPLEX 3M LSZH	8	5.00E+08	0.00	6.25E+07	0.02	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.17.28	SIGNALLING - DCS TYPE 1A	CABLE-PATCH F/O SM DPX SC-SC 3M LSZH	8	5.00E+08	0.00	6.25E+07	0.02	MIL-HDBK-217F	0.25	0.05	0.02	0.15	0.00	0.10	0.57	1.00000000
7.17.29	SIGNALLING - DCS TYPE 1A	CABLE-PATCH F/O SM DPX LC-LC 2M LSZH	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.17.30	SIGNALLING - DCS TYPE 1A	CABLE-PATCH F/O SM DPX LC-SC 3M LSZH	12	5.00E+08	0.00	4.17E+07	0.02	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.17.31	SIGNALLING - DCS TYPE 1A	CABLE-PATCH F/O SM DPX LC-SC 2M LSZH	2	5.00E+08	0.00	2.50E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.17.32	SIGNALLING - DCS TYPE 1A	CON-POWER IEC 60309 FML 2P+E 250V 32A	2	1.00E+09	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.10	0.00	0.10	0.52	1.00000000
7.18	SIGNALLING - DCS TYPE 1B	RACK ASSEMBLY-DCS TYPE 1B-GENERIC	1	5.88E+03	170.11	5.88E+03	170.11									1.00000000
7.18.1	SIGNALLING - DCS TYPE 1B	SUBRACK ASSEMBLY-SECURITY DEVICE 5 EPCM	3	2.37E+04	42.28	7.88E+03	126.84		0.25	0.05	0.02	0.15	0.00	0.10	0.57	0.99997590
7.18.1.1	SIGNALLING - DCS TYPE 1B	PSA-AC/DC 5V (100W)	2	5.00E+05	2.00	2.50E+05	4.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999916
7.18.1.2	SIGNALLING - DCS TYPE 1B	PBA-EPCM (8HP/4GB) NON-VITAL	5	1.44E+05	6.94	2.88E+04	34.72	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999708
7.18.1.3	SIGNALLING - DCS TYPE 1B	SUBRACK-SECURITY DEVICE 5 EPCM	1	1.41E+06	0.71	1.41E+06	0.71	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999970
7.18.2	SIGNALLING - DCS TYPE 1B	PATCH PANEL-24 PORT RJ45 CATSE SHIELD	1	6.32E+05	1.58	6.32E+05	1.58	OEM Data	0.25	0.05	0.02	0.15	0.00	0.05	0.52	0.99999918
7.18.3	SIGNALLING - DCS TYPE 1B	MODULE-MEDIA MSM40-4TX	6	3.79E+06	0.26	6.31E+05	1.58	OEM Data	0.25	0.05	0.01	0.05	0.00	0.10	0.46	0.99999988
7.18.4	SIGNALLING - DCS TYPE 1B	MODULE-ETHERNET SW16+4 PORT MSP30	2	2.12E+05	4.72	1.06E+05	9.43	OEM Data	0.25	0.05	0.02	0.15	0.00	0.05	0.52	0.99999755
7.18.5	SIGNALLING - DCS TYPE 1B	CORD-PWR AC 10A/250V C13 C14 2.5M	10	1.00E+09	0.00	1.00E+08	0.01	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.18.6	SIGNALLING - DCS TYPE 1B	MODULE-SWITCH PSU TYP RSP120 EEC	2	5.19E+05	1.93	2.60E+05	3.85	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999921
7.18.7	SIGNALLING - DCS TYPE 1B	CABLE-PATCH CATSE UTP GRY 2M LSZH	4	5.00E+08	0.00	1.25E+08	0.01	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.18.8	SIGNALLING - DCS TYPE 1B	CABLE-PATCH CATSE UTP RED XVR 2M LSZH	12	5.00E+08	0.00	4.17E+07	0.02	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.18.9	SIGNALLING - DCS TYPE 1B	CABLE ASSEMBLY-ETHERNET INTERFACE 4.0 MR	11	5.00E+08	0.00	4.55E+07	0.02	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.18.10	SIGNALLING - DCS TYPE 1B	CABLE-PATCH CATSE UTP RED XVR 1.5M LSZH	7	5.00E+08	0.00	7.14E+07	0.01	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.18.11	SIGNALLING - DCS TYPE 1B	PWR BAR-30-C13 6-C19 OUTLETS 32A VERT	2	2.56E+07	0.04	1.28E+07	0.08	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999998
7.18.12	SIGNALLING - DCS TYPE 1B	FAN TRAY-19" 1U 3X105 CFM FAN 90-264VAC	2	7.50E+04	13.33	3.75E+04	26.67	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999453
7.18.13	SIGNALLING - DCS TYPE 1B	CON-POWER IEC 60309 FML 2P+E 250V 32A	2	1.00E+09	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.19	SIGNALLING - DCS TYPE 2A	RACK ASSEMBLY-DCS TYPE 2A	1	5.29E+03	188.98	5.29E+03	188.98									1.00000000
7.19.1	SIGNALLING - DCS TYPE 2A	PWR BAR-30-C13 6-C19 OUTLETS 32A VERT	2	2.56E+07	0.04	1.28E+07	0.08	Demonstrated field data	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999998
7.19.2	SIGNALLING - DCS TYPE 2A	PATCH PANEL-24 PORT RJ45 CATSE SHIELD	1	6.32E+05	1.58	6.32E+05	1.58	OEM Data	0.25	0.05	0.02	0.15	0.00	0.05	0.52	0.99999918
7.19.3	SIGNALLING - DCS TYPE 2A	PANEL-FIBER COUPLER SM 6 SC DUPLEX	6	2.13E+05	4.70	3.55E+04	28.20	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999803
7.19.4	SIGNALLING - DCS TYPE 2A	CABLE-PATCH CATSE UTP GRY 2M LSZH	36	5.00E+08	0.00	1.39E+07	0.07	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.19.5	SIGNALLING - DCS TYPE 2A	CORD-PWR AC 10A/250V C13 C14 2.5M	10	1.00E+09	0.00	1.00E+08	0.01	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.19.6	SIGNALLING - DCS TYPE 2A	PSU-12VDC SA I/P 85-264VAC 45-65HZ DIN	2	1.85E+06	0.54	9.26E+05	1.08	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999978
7.19.7	SIGNALLING - DCS TYPE 2A	CABLE ASSEMBLY-SDR POWER 2M	4	1.00E+09	0.00	2.50E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.19.8	SIGNALLING - DCS TYPE 2A	MODULE-ETHERNET SW16+4 PORT MSP30	2	2.12E+05	4.72	1.06E+05	9.43	OEM Data	0.25	0.05	0.02	0.15	0.00	0.05	0.52	0.99999755
7.19.9	SIGNALLING - DCS TYPE 2A	MODULE-ETHERNET SW L2E 10 PORT MS30	1	4.04E+05	2.48	4.04E+05	2.48	OEM Data	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999884
7.19.10	SIGNALLING - DCS TYPE 2A	MODULE-MEDIA SW SGL MM2-4TX1	8	3.79E+06	0.26	4.73E+05	2.11	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999989
7.19.11	SIGNALLING - DCS TYPE 2A	MODULE-ETHERNET SW 9 PORT MANAGED	2	4.26E+05	2.35	2.13E+05	4.70	OEM Data	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999890
7.19.12	SIGNALLING - DCS TYPE 2A	MODULE-ETHERNET SW L2E 18 PORT MS30	2	2.85E+05	3.51	1.42E+05	7.02	OEM Data	0.25	0.05	0.02	0.15	0.00	0.05	0.52	0.99999817
7.19.13	SIGNALLING - DCS TYPE 2A	CBTC RADIO 1964500-901	4	6.58E+05	1.52	1.64E+05	6.08	MIL-HDBK-217F	0.25	0.05	0.01	0.10	0.00	0.05	0.46	0.99999930
7.19.14	SIGNALLING - DCS TYPE 2A	FAN TRAY-19" 1U 3X105 CFM FAN 90-264VAC	2	7.50E+04	13.33	3.75E+04	26.67	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999453
7.19.15	SIGNALLING - DCS TYPE 2A	TRANSCVR-SM LC DUP SFP100 TX/RX1310 30KM	6	7.33E+05	1.37	1.22E+05	8.19	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999944
7.19.16	SIGNALLING - DCS TYPE 2A	MODULE-MEDIA MSM20-2FX-SM-DSC/2TX	2	5.69E+05	1.76	2.84E+05	3.52	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999928
7.19.17	SIGNALLING - DCS TYPE 2A	MODULE-MEDIA MSM40-4TX	2	5.69E+05	1.76	2.84E+05	3.52	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999928
7.19.18	SIGNALLING - DCS TYPE 2A	TRANSCVR-SM LC DUP SFP 1000BASE-LHX 30KM	2	2.82E+05	3.55	1.41E+05	7.10	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999855
7.19.19	SIGNALLING - DCS TYPE 2A	MODULE-MEDIA SW MM4-2TX/SFP	3	1.43E+06	0.70	4.76E+05	2.10	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999971

Ref.	System	Description	QPU	MTBF (hrs)	FR A	Total MTBF	A x QTY	Data Source	Logistic	Access	Isolation	Remove & Replace	Alignment	Test	TOTAL	Availability
7.19.20	SIGNALLING - DCS TYPE 2A	TRANSCVR-SM LC DUP SFP 1000BASE-LX 10KM	2	2.82E+0S	3.55	1.41E+05	7.10	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999855
7.19.21	SIGNALLING - DCS TYPE 2A	MODULE-MEDIA SW M-SFP-LX/LC	6	3.79E+06	0.26	6.31E+0S	1.58	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999989
7.19.22	SIGNALLING - DCS TYPE 2A	MODULE-SWITCH PSU TYP RSP120 EEC	6	5.19E+05	1.93	8.66E+04	11.55	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999921
7.19.23	SIGNALLING - DCS TYPE 2A	CABLE-PATCH CATSE UTP GRY 3M LSZH	30	5.00E+08	0.00	1.67E+07	0.06	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.19.24	SIGNALLING - DCS TYPE 2A	PANEL-FIBRE COUPLER 6 SC DUP 4.3"X1.38"	2	2.13E+05	4.70	1.06E+05	9.40	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999803
7.19.25	SIGNALLING - DCS TYPE 2A	TRANSCVR-MM LC DUP SFP 1000BASE-SX 2KM	8	6.85E+05	1.46	8.56E+04	11.68	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999940
7.19.26	SIGNALLING - DCS TYPE 2A	CABLE-PATCH CORD LC/SC MM DUPLEX 3M LSZH	8	5.00E+08	0.00	6.25E+07	0.02	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.19.27	SIGNALLING - DCS TYPE 2A	CABLE-PATCH F/O SM DPX SC-SC 3M LSZH	4	5.00E+08	0.00	1.25E+08	0.01	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.19.28	SIGNALLING - DCS TYPE 2A	CABLE-PATCH F/O SM DPX LC-LC 2M LSZH	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.19.29	SIGNALLING - DCS TYPE 2A	CABLE-PATCH F/O SM DPX LC-SC 3M LSZH	12	5.00E+08	0.00	4.17E+07	0.02	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.19.30	SIGNALLING - DCS TYPE 2A	CABLE-PATCH F/O SM DPX LC-SC 2M LSZH	2	5.00E+08	0.00	2.50E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.19.31	SIGNALLING - DCS TYPE 2A	PATCH PANEL-48 PORT RJ45 CATSE SHIELD	1	3.16E+05	3.16	3.16E+05	3.16	OEM Data	0.25	0.05	0.01	0.20	0.00	0.05	0.56	0.99999823
7.19.32	SIGNALLING - DCS TYPE 2A	PANEL-PATCH FIBER 4-PORT 1U	1	2.23E+06	0.45	2.23E+06	0.45	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999982
7.19.33	SIGNALLING - DCS TYPE 2A	MODULE-SWITCH PSU TYP RSP120 EEC	6	2.00E+05	5.00	3.33E+04	30.00	OEM Data	0.25	0.05	0.01	0.10	0.00	0.05	0.46	0.99999770
7.19.34	SIGNALLING - DCS TYPE 2A	CON-POWER IEC 60309 FML 2P+E 250V 32A	2	1.00E+09	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.01	0.10	0.00	0.05	0.46	1.00000000
7.20	SIGNALLING - DCS TYPE 2B	RACK ASSEMBLY-DCS TYPE 2B	1	4.25E+03	235.09	4.25E+03	235.09									1.00000000
7.20.1	SIGNALLING - DCS TYPE 2B	SUBRACK ASSEMBLY-SECURITY DEVICE 5 EPCM	2	2.37E+04	42.28	1.18E+04	84.56		0.25	0.05	0.02	0.15	0.00	0.10	0.57	0.99997590
7.20.1.1	SIGNALLING - DCS TYPE 2B	PSA-AC/DC SV (100W)	2	5.00E+05	2.00	2.50E+05	4.00	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999916
7.20.1.2	SIGNALLING - DCS TYPE 2B	PBA-EPCM (8HP/4GB) NON-VITAL	5	1.44E+0S	6.94	2.88E+04	34.72	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999708
7.20.1.3	SIGNALLING - DCS TYPE 2B	SUBRACK-SECURITY DEVICE 5 EPCM	1	1.41E+06	0.71	1.41E+06	0.71	MIL-HDBK-217F	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999970
7.20.2	SIGNALLING - DCS TYPE 2B	PATCH PANEL-24 PORT RJ45 CATSE SHIELD	1	6.32E+0S	1.58	6.32E+0S	1.58	OEM Data	0.25	0.05	0.02	0.15	0.00	0.05	0.52	0.99999918
7.20.3	SIGNALLING - DCS TYPE 2B	MODULE-MEDIA MSM40-4TX	6	3.79E+06	0.26	6.31E+05	1.58	OEM Data	0.25	0.05	0.01	0.05	0.00	0.10	0.46	0.99999988
7.20.4	SIGNALLING - DCS TYPE 2B	MODULE-ETHERNET SW16+4 PORT MSP30	2	2.12E+0S	4.72	1.06E+0S	9.43	OEM Data	0.25	0.05	0.02	0.15	0.00	0.05	0.52	0.99999755
7.20.5	SIGNALLING - DCS TYPE 2B	CORD-PWR AC 10A/250V C13 C14 2.SM	15	1.00E+09	0.00	6.67E+07	0.02	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.20.6	SIGNALLING - DCS TYPE 2B	MODULE-SWITCH PSU TYP RSP120 EEC	2	5.19E+0S	1.93	2.60E+05	3.85	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999921
7.20.7	SIGNALLING - DCS TYPE 2B	CABLE-PATCH CATSE UTP GRY 2M LSZH	40	5.00E+08	0.00	1.25E+07	0.08	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.20.8	SIGNALLING - DCS TYPE 2B	CABLE-PATCH CATSE UTP RED XVR 2M LSZH	10	5.00E+08	0.00	5.00E+07	0.02	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.20.9	SIGNALLING - DCS TYPE 2B	CABLE ASSEMBLY-ETHERNET INTERFACE 4.0 MR	10	5.00E+08	0.00	5.00E+07	0.02	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.20.10	SIGNALLING - DCS TYPE 2B	CABLE-PATCH CATSE UTP RED XVR 1.5M LSZH	7	5.00E+08	0.00	7.14E+07	0.01	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.20.11	SIGNALLING - DCS TYPE 2B	PWR BAR-30-C13 6-C19 OUTLETS 32A VERT	2	2.56E+07	0.04	1.28E+07	0.08	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999998
7.20.12	SIGNALLING - DCS TYPE 2B	FAN TRAY-19" 1U 3X105 CFM FAN 90-264VAC	2	7.50E+04	13.33	3.75E+04	26.67	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999453
7.20.13	SIGNALLING - DCS TYPE 2B	CON-POWER IEC 60309 FML 2P+E 250V 32A	2	1.00E+09	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.20.14	SIGNALLING - DCS TYPE 2B	PC ASSY-DATA RECORDER	1	3.64E+04	27.49	3.64E+04	27.49		0.25	0.05	0.01	0.10	0.00	0.05	0.46	0.99998735
7.20.14.1	SIGNALLING - DCS TYPE 2B	PSU-DL360/380 100/240VAC I/P S00W G9	1	3.50E+05	2.86	3.50E+05	2.86	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999880
7.20.14.2	SIGNALLING - DCS TYPE 2B	DRIVE-DVD R/W INTERNAL SATA 9.5MM G9	1	1.25E+05	8.00	1.25E+05	8.00	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999664
7.20.14.3	SIGNALLING - DCS TYPE 2B	HARD DRIVE-600GB 6G 10K SFF SAS G8/G9	4	1.25E+06	0.80	3.13E+0S	3.20	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999966
7.20.14.4	SIGNALLING - DCS TYPE 2B	PBA-NIC 10/100/1000 PCI-E 4-PORT G8/G9	1	2.46E+05	4.07	2.46E+05	4.07	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999829
7.20.14.5	SIGNALLING - DCS TYPE 2B	PC-PROL DL380 G9 ES-2620 2.4GHZ 16GB 2U	1	1.07E+05	9.37	1.07E+05	9.37	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999607
7.20.15	SIGNALLING - DCS TYPE 2B	PC ASSEMBLY-DIAGNOSTIC COLLECTOR	1	6.90E+04	14.50	6.90E+04	14.50		0.25	0.05	0.01	0.10	0.00	0.05	0.46	0.99999333
7.20.15.1	SIGNALLING - DCS TYPE 2B	PC-WORKSTATION Z440 QC 2.8GHZ 4GB 500GB	1	9.80E+04	10.20	9.80E+04	10.20	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999572
7.20.15.2	SIGNALLING - DCS TYPE 2B	PBA-NIC PCIe GIGABIT Z420/Z440 DUAL	2	6.25E+05	1.60	3.13E+05	3.20	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999933
7.20.15.3	SIGNALLING - DCS TYPE 2B	PBA-GRAPHIC PCIE 1024MB DUAL HEAD LP	1	1.79E+06	0.56	1.79E+06	0.56	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999976
7.20.15.4	SIGNALLING - DCS TYPE 2B	PC-PROL DL380 G9 E5-2620 2.4GHZ 16GB 2U	1	1.87E+06	0.54	1.87E+06	0.54	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999977
7.20.16	SIGNALLING - DCS TYPE 2B	PATCH PANEL-48 PORT RJ45 CAT5E SHIELD	1	3.16E+05	3.16	3.16E+05	3.16	OEM Data	0.25	0.05	0.02	0.20	0.00	0.05	0.57	0.99999820
7.20.17	SIGNALLING - DCS TYPE 2B	KEYBOARD-INTEGRATED MON 19" 2U DVI-D US	1	5.00E+04	20.00	5.00E+04	20.00	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999180
7.20.18	SIGNALLING - DCS TYPE 2B	KVM SWITCH-4PORT USB/PS2 RM	1	5.00E+05	2.00	5.00E+05	2.00	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999918
7.20.19	SIGNALLING - DCS TYPE 2B	NETWORK SWITCH-24P+4G 10/100 MODULAR	2	2.00E+05	5.00	1.00E+05	10.00	OEM Data	0.25	0.05	0.01	0.15	0.00	0.05	0.51	0.99999745
7.20.20	SIGNALLING - DCS TYPE 2B	CABLE-UTP PATCH CORD CAT5E GREY SM LSZH	8	5.00E+08	0.00	6.25E+07	0.02	MIL HDBK 217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.20.21	SIGNALLING - DCS TYPE 2B	CABLE-PATCH CATSE UTP GRY 1M LSZH	4	5.00E+08	0.00	1.25E+08	0.01	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.20.22	SIGNALLING - DCS TYPE 2B	MODULE-8 PORT EXPANSION 10/100BASE-TX	6	2.00E+05	5.00	3.33E+04	30.00	OEM Data	0.25	0.05	0.01	0.10	0.00	0.05	0.46	0.99999770

OLR-05-0-0000-REP-0059	Interface Hazard Analysis	
Revision: 2	Date: 23 May 2019	Owner: M. Williamson

Ref.	System	Description	QPU	MTBF (hrs)	FR A	Total MTBF	A x QTY	Data Source	Logistic	Access	Isolation	Remove & Replace	Alignment	Test	TOTAL	Availability
7.20.23	SIGNALLING - DCS TYPE 2B	CABLE-KVM SWITCH PS2/USB 9'	2	5.00E+08	0.00	2.50E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.21	SIGNALLING - DCS TYPE 4	RACK ASSEMBLY-DCS TYPE 4-GENERIC	1	7.17E+03	139.38	7.17E+03	139.38									1.00000000
7.21.1	SIGNALLING - DCS TYPE 4	PWR BAR-30-C13 6-C19 OUTLETS 32A VERT	2	2.56E+07	0.04	1.28E+07	0.08	Demonstrated field data	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999998
7.21.2	SIGNALLING - DCS TYPE 4	PANEL-FIBER COUPLER SM 6 SC DUPLEX	3	2.13E+05	4.70	7.09E+04	14.10	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999803
7.21.3	SIGNALLING - DCS TYPE 4	CABLE-PATCH CATSE UTP GRY 2M LSZH	24	5.00E+08	0.00	2.08E+07	0.05	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.21.4	SIGNALLING - DCS TYPE 4	CORD-PWR AC 10A/250V C13 C14 2.5M	9	1.00E+09	0.00	1.11E+08	0.01	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.21.5	SIGNALLING - DCS TYPE 4	CABLE-PATCH CATSE UTP GRY 1M LSZH	4	5.00E+08	0.00	1.25E+08	0.01	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.21.6	SIGNALLING - DCS TYPE 4	CABLE-UTP PATCH CORD CATSE GREY SM LSZH	8	5.00E+08	0.00	6.25E+07	0.02	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.21.7	SIGNALLING - DCS TYPE 4	PANEL-PATCH FIBER 4-PORT 1U	2	2.23E+06	0.45	1.12E+06	0.90	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999982
7.21.8	SIGNALLING - DCS TYPE 4	ADAPTER-DISPLAYPORT TO VGA 8"	1	4.57E+06	0.22	4.57E+06	0.22	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999991
7.21.9	SIGNALLING - DCS TYPE 4	FAN TRAY-19" 1U 3X105 CFM FAN 90-264VAC	2	7.50E+04	13.33	3.75E+04	26.67	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999453
7.21.10	SIGNALLING - DCS TYPE 4	TRANSCVR-SM LC DUP SFP100 TX/RX1310 30KM	4	7.33E+05	1.37	1.83E+05	5.46	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999944
7.21.11	SIGNALLING - DCS TYPE 4	PATCH PANEL-48 PORT RJ45 CATSE SHIELD	1	3.16E+05	3.16	3.16E+05	3.16	OEM Data	0.25	0.05	0.01	0.20	0.00	0.05	0.56	0.99999823
7.21.12	SIGNALLING - DCS TYPE 4	CABLE-KVM SWITCH PS2/USB 9'	2	5.00E+08	0.00	2.50E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.21.13	SIGNALLING - DCS TYPE 4	CORD-PWR AC 12A/125V C14 TO NEMA5-15 2'	1	1.00E+09	0.00	1.00E+09	0.00	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.21.14	SIGNALLING - DCS TYPE 4	PANEL-FIBRE COUPLER 6 SC DUP 4.3"X1.38"	1	2.13E+05	4.70	2.13E+05	4.70	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999803
7.21.15	SIGNALLING - DCS TYPE 4	CABLE-PATCH F/O SM DPX SC-SC 3M LSZH	8	5.00E+08	0.00	6.25E+07	0.02	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.21.16	SIGNALLING - DCS TYPE 4	CABLE-PATCH F/O SM DPX LC-SC 3M LSZH	4	5.00E+08	0.00	1.25E+08	0.01	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.21.17	SIGNALLING - DCS TYPE 4	KVM SWITCH-4PORT USB/PS2 RM	1	5.00E+05	2.00	5.00E+05	2.00	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999918
7.21.18	SIGNALLING - DCS TYPE 4	NETWORK SWITCH-24P+4G 10/100 MODULAR	2	2.00E+05	5.00	1.00E+05	10.00	OEM Data	0.25	0.05	0.01	0.15	0.00	0.05	0.51	0.99999745
7.21.19	SIGNALLING - DCS TYPE 4	MODULE-8 PORT EXPANSION 10/100BASE-TX	4	2.00E+05	5.00	5.00E+04	20.00	OEM Data	0.25	0.05	0.01	0.10	0.00	0.05	0.46	0.99999770
7.21.20	SIGNALLING - DCS TYPE 4	MODULE-2 SFP+4 100BASE-FX/SC SM EXPANSN	2	2.00E+05	5.00	1.00E+05	10.00	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999795
7.21.21	SIGNALLING - DCS TYPE 4	CON-POWER IEC 60309 FML 2P+E 250V 32A	2	1.00E+09	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.01	0.10	0.00	0.05	0.46	1.00000000
7.21.22	SIGNALLING - DCS TYPE 4	PC ASSEMBLY-DIAGNOSTIC COLLECTOR	1	6.90E+04	14.50	6.90E+04	14.50		0.25	0.05	0.01	0.10	0.00	0.05	0.46	0.99999333
7.21.22.1	SIGNALLING - DCS TYPE 4	PC-WORKSTATION Z440 QC 2.8GHZ 4GB 500GB	1	9.80E+04	10.20	9.80E+04	10.20	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999572
7.21.22.2	SIGNALLING - DCS TYPE 4	PBA-NIC PCIe GIGABIT Z420/Z440 DUAL	2	6.25E+05	1.60	3.13E+05	3.20	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999933
7.21.22.3	SIGNALLING - DCS TYPE 4	PBA-GRAPHIC PCIE 1024MB DUAL HEAD LP	1	1.79E+06	0.56	1.79E+06	0.56	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999976
7.21.22.4	SIGNALLING - DCS TYPE 4	PC-PROL DL380 G9 E5-2620 2.4GHZ 16GB 2U	1	1.87E+06	0.54	1.87E+06	0.54	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999977
7.21.23	SIGNALLING - DCS TYPE 4	PC ASSEMBLY-DATA RECORDER	1	3.64E+04	27.49	3.64E+04	27.49		0.25	0.05	0.01	0.10	0.00	0.05	0.46	0.99998735
7.21.23.1	SIGNALLING - DCS TYPE 4	PSU-DL360/380 100/240VAC I/P S00W G9	1	3.50E+05	2.86	3.50E+05	2.86	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999880
7.21.23.2	SIGNALLING - DCS TYPE 4	DRIVE-DVD R/W INTERNAL SATA 9.5MM G9	1	1.25E+05	8.00	1.25E+05	8.00	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999664
7.21.23.3	SIGNALLING - DCS TYPE 4	HARD DRIVE-600GB 6G 10K SFF SAS G8/G9	4	1.25E+06	0.80	3.13E+05	3.20	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999966
7.21.23.4	SIGNALLING - DCS TYPE 4	PBA-NIC 10/100/1000PCI-E 4-PORT G8/G9	1	2.46E+05	4.07	2.46E+05	4.07	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999829
7.21.23.5	SIGNALLING - DCS TYPE 4	PC-PROL DL380 G9 E5-2620 2.4GHZ 16GB 2U	1	1.07E+05	9.37	1.07E+05	9.37	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999607
7.21	SIGNALLING - DCS TYPE 6	RACK ASSEMBLY-DCS TYPE 6-GENERIC	2	1.06E+04	94.72	5.28E+03	189.44									1.00000000
7.21.1	SIGNALLING - DCS TYPE 6	PWR BAR-30-C13 6-C19 OUTLETS 32A VERT	2	2.56E+07	0.04	1.28E+07	0.08	Demonstrated field data	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999998
7.21.2	SIGNALLING - DCS TYPE 6	PATCH PANEL-24 PORT RJ45 CATSE SHIELD	2	6.32E+05	1.58	3.16E+05	3.16	OEM Data	0.25	0.05	0.02	0.15	0.00	0.05	0.52	0.99999918
7.21.3	SIGNALLING - DCS TYPE 6	PANEL-FIBER COUPLER SM 6 SC DUPLEX	3	2.13E+05	4.70	7.09E+04	14.10	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999803
7.21.4	SIGNALLING - DCS TYPE 6	CABLE-PATCH CATSE UTP GRY 2M LSZH	32	5.00E+08	0.00	1.56E+07	0.06	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.21.5	SIGNALLING - DCS TYPE 6	CORD-PWR AC 10A/250V C13 C14 2.SM	4	1.00E+09	0.00	2.50E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.21.6	SIGNALLING - DCS TYPE 6	CABLE-PATCH CATSE UTP GRY 1M LSZH	4	5.00E+08	0.00	1.25E+08	0.01	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.21.7	SIGNALLING - DCS TYPE 6	PANEL-PATCH FIBER 4-PORT 1U	1	2.23E+06	0.45	2.23E+06	0.45	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999982
7.21.8	SIGNALLING - DCS TYPE 6	NETWORK SWITCH-24P+4G 10/100 MODULAR	2	2.00E+05	5.00	1.00E+05	10.00	OEM Data	0.25	0.05	0.01	0.15	0.00	0.05	0.51	0.99999745
7.21.9	SIGNALLING - DCS TYPE 6	FAN TRAY-19" 1U 3X105 CFM FAN 90-264VAC	2	7.50E+04	13.33	3.75E+04	26.67	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999453
7.21.10	SIGNALLING - DCS TYPE 6	TRANSCVR-SM LC DUP SFP100 TX/RX1310 30KM	4	7.33E+05	1.37	1.83E+05	5.46	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999944
7.21.11	SIGNALLING - DCS TYPE 6	MODULE-8 PORT EXPANSION 10/100BASE-TX	4	2.00E+05	5.00	5.00E+04	20.00	OEM Data	0.25	0.05	0.01	0.10	0.00	0.05	0.46	0.99999770
7.21.12	SIGNALLING - DCS TYPE 6	PANEL-FIBRE COUPLER 6 SC DUP 4.3"X1.38"	1	2.13E+05	4.70	2.13E+05	4.70	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999803
7.21.13	SIGNALLING - DCS TYPE 6	CABLE-PATCH F/O SM DPX SC-SC 3M LSZH	8	5.00E+08	0.00	6.25E+07	0.02	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.21.14	SIGNALLING - DCS TYPE 6	CABLE-PATCH F/O SM DPX LC-SC 3M LSZH	4	5.00E+08	0.00	1.25E+08	0.01	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.21.15	SIGNALLING - DCS TYPE 6	MODULE-2 SFP+4 100BASE-FX/SC SM EXPANSN	2	2.00E+05	5.00	1.00E+05	10.00	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999795

Ref.	System	Description	QPU	MTBF (hrs)	FR A	Total MTBF	λ x QTY	Data Source	Logistic	Access	Isolation	Remove & Replace	Alignment	Test	TOTAL	Availability
7.21.16	SIGNALLING - DCS TYPE 6	CON-POWER IEC 60309 FML 2P+E 250V 32A	2	1.00E+09	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.22	SIGNALLING - DCS TYPE 9	RACK ASSEMBLY-DCS TYPE 9-GENERIC	3	5.28E+03	189.41	1.76E+03	568.23									1.00000000
7.22.1	SIGNALLING - DCS TYPE 9	PWR BAR-30-C13 6-C19 OUTLETS 32A VERT	2	2.56E+07	0.04	1.28E+07	0.08	Demonstrated field data	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999998
7.22.2	SIGNALLING - DCS TYPE 9	PATCH PANEL-24 PORT RJ45 CAT5E SHIELD	1	6.32E+05	1.58	6.32E+05	1.58	OEM Data	0.25	0.05	0.01	0.15	0.00	0.05	0.51	0.99999919
7.22.3	SIGNALLING - DCS TYPE 9	PANEL-FIBER COUPLER SM 6 SC DUPLEX	4	2.13E+05	4.70	5.32E+04	18.80	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999803
7.22.4	SIGNALLING - DCS TYPE 9	CABLE-PATCH CAT5E UTP GRY 2M LSZH	24	5.00E+08	0.00	2.08E+07	0.05	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.22.5	SIGNALLING - DCS TYPE 9	CORD-PWR AC 10A/250V C13 C14 2.5M	13	1.00E+09	0.00	7.69E+07	0.01	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.22.6	SIGNALLING - DCS TYPE 9	CABLE-PATCH CAT5E UTP GRY 1M LSZH	4	5.00E+08	0.00	1.25E+08	0.01	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.22.7	SIGNALLING - DCS TYPE 9	PSU-12VDC 5A I/P 85-264VAC 45-65HZ DIN	2	1.85E+06	0.54	9.26E+05	1.08	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999978
7.22.8	SIGNALLING - DCS TYPE 9	CABLE-UTP PATCH CORD CAT5E GREY 5M LSZH	16	5.00E+08	0.00	3.13E+07	0.03	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.22.9	SIGNALLING - DCS TYPE 9	CABLE ASSEMBLY-SDR POWER 2M	4	1.00E+09	0.00	2.50E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.22.10	SIGNALLING - DCS TYPE 9	MODULE-MEDIA SW SGL MM2-4TX1	2	3.79E+06	0.26	1.89E+06	0.53	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999989
7.22.11	SIGNALLING - DCS TYPE 9	PANEL-PATCH FIBER 4-PORT 1U	2	2.23E+06	0.45	1.12E+06	0.90	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999982
7.22.12	SIGNALLING - DCS TYPE 9	MODULE-ETHERNET SW L2E 18 PORT MS30	1	2.85E+05	3.51	2.85E+05	3.51	OEM Data	0.25	0.05	0.01	0.15	0.00	0.05	0.51	0.99999821
7.22.13	SIGNALLING - DCS TYPE 9	CBTC RADIO 1964500-901	4	6.58E+05	1.52	1.64E+05	6.08	OEM Data	0.25	0.05	0.01	0.10	0.00	0.05	0.46	0.99999930
7.22.14	SIGNALLING - DCS TYPE 9	ADAPTER-DISPLAYPORT TO VGA 8"	1	4.57E+06	0.22	4.57E+06	0.22	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999991
7.22.15	SIGNALLING - DCS TYPE 9	FAN TRAY-19" 1U 3X105 CFM FAN 90-264VAC	2	7.50E+04	13.33	3.75E+04	26.67	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999453
7.22.16	SIGNALLING - DCS TYPE 9	TRANSCVR-SM LC DUP SFP100 TX/RX1310 30KM	4	7.33E+05	1.37	1.83E+05	5.46	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999944
7.22.17	SIGNALLING - DCS TYPE 9	PATCH PANEL-48 PORT RJ45 CAT5E SHIELD	1	3.16E+05	3.16	3.16E+05	3.16	OEM Data	0.25	0.05	0.01	0.20	0.00	0.05	0.56	0.99999823
7.22.18	SIGNALLING - DCS TYPE 9	MODULE-MEDIA SW MM4-2TX/SFP	1	1.43E+06	0.70	1.43E+06	0.70	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999971
7.22.19	SIGNALLING - DCS TYPE 9	CABLE-KVM SWITCH PS2/USB 9'	3	5.00E+08	0.00	1.67E+08	0.01	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.22.20	SIGNALLING - DCS TYPE 9	CORD-PWR AC 12A/125V C14 TO NEMA5-15 2'	1	1.00E+09	0.00	1.00E+09	0.00	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.22.21	SIGNALLING - DCS TYPE 9	MODULE-MEDIA SW M-SFP-LX/LC	2	3.79E+06	0.26	1.89E+06	0.53	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999989
7.22.22	SIGNALLING - DCS TYPE 9	MODULE-SWITCH PSU TYP RSP120 EEC	2	5.19E+05	1.93	2.60E+05	3.85	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999921
7.22.23	SIGNALLING - DCS TYPE 9	CABLE-PATCH CAT5E UTP GRY 3M LSZH	28	5.00E+08	0.00	1.79E+07	0.06	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.22.24	SIGNALLING - DCS TYPE 9	PANEL-FIBRE COUPLER 6 SC DUP 4.3"X1.38"	4	2.13E+05	4.70	5.32E+04	18.80	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999803
7.22.25	SIGNALLING - DCS TYPE 9	TRANSCVR-MM LC DUP SFP 1000BASE-SX 2KM	8	6.85E+05	1.46	8.56E+04	11.68	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999940
7.22.26	SIGNALLING - DCS TYPE 9	CABLE-PATCH CORD LC/SC MM DUPLEX 3M LSZH	8	5.00E+08	0.00	6.25E+07	0.02	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.22.27	SIGNALLING - DCS TYPE 9	CABLE-PATCH F/O SM DPX SC-SC 3M LSZH	8	5.00E+08	0.00	6.25E+07	0.02	Analogy to similar item	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.22.28	SIGNALLING - DCS TYPE 9	CABLE-PATCH F/O SM DPX LC-SC 3M LSZH	6	5.00E+08	0.00	8.33E+07	0.01	MIL-HDBK-217F	0.25	0.05	0.01	0.05	0.00	0.05	0.41	1.00000000
7.22.29	SIGNALLING - DCS TYPE 9	PATCH PANEL-24 PORT RJ45 CAT5E SHIELD	1	6.32E+05	1.58	6.32E+05	1.58	OEM Data	0.25	0.05	0.01	0.15	0.00	0.05	0.51	0.99999919
7.22.30	SIGNALLING - DCS TYPE 9	KVM SWITCH-4PORT USB/PS2 RM	1	5.00E+05	2.00	5.00E+05	2.00	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999918
7.22.31	SIGNALLING - DCS TYPE 9	NETWORK SWITCH-24P+4G 10/100 MODULAR	2	2.00E+05	5.00	1.00E+05	10.00	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999795
7.22.32	SIGNALLING - DCS TYPE 9	MODULE-8 PORT EXPANSION 10/100BASE-TX	4	2.00E+05	5.00	5.00E+04	20.00	OEM Data	0.25	0.05	0.01	0.10	0.00	0.05	0.46	0.99999770
7.22.33	SIGNALLING - DCS TYPE 9	MODULE-2 SFP+4 100BASE-FX/SC SM EXPANSN	2	2.00E+05	5.00	1.00E+05	10.00	OEM Data	0.25	0.05	0.01	0.05	0.00	0.05	0.41	0.99999795
7.22.34	SIGNALLING - DCS TYPE 9	CON-POWER IEC 60309 FML 2P+E 250V 32A	2	1.00E+09	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.01	0.10	0.00	0.05	0.46	1.00000000
7.22.35	SIGNALLING - DCS TYPE 9	PC ASSEMBLY-DIAGNOSTIC COLLECTOR	1	6.90E+04	14.50	6.90E+04	14.50		0.25	0.05	0.01	0.10	0.00	0.05	0.46	0.99999333
7.22.35.1	SIGNALLING - DCS TYPE 9	PC-WORKSTATION Z440 QC 2.8GHZ 4GB 500GB	1	9.80E+04	10.20	9.80E+04	10.20	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999572
7.22.35.2	SIGNALLING - DCS TYPE 9	PBA-NIC PCIe GIGABIT Z420/Z440 DUAL	2	6.25E+05	1.60	3.13E+05	3.20	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999933
7.22.35.3	SIGNALLING - DCS TYPE 9	PBA-GRAPHIC PCIE 1024MB DUAL HEAD LP	1	1.79E+06	0.56	1.79E+06	0.56	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999976
7.22.35.4	SIGNALLING - DCS TYPE 9	PC-PROL DL380 G9 E5-2620 2.4GHZ 16GB 2U	1	1.87E+06	0.54	1.87E+06	0.54	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999977
7.22.36	SIGNALLING - DCS TYPE 9	PC ASSEMBLY-DATA RECORDER	1	3.64E+04	27.49	3.64E+04	27.49		0.25	0.05	0.01	0.10	0.00	0.05	0.46	0.99998735
7.22.36.1	SIGNALLING - DCS TYPE 9	PSU-DL360/380 100/240VAC I/P 500W G9	1	3.50E+05	2.86	3.50E+05	2.86	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999880
7.22.36.2	SIGNALLING - DCS TYPE 9	DRIVE-DVD R/W INTERNAL SATA 9.5MM G9	1	1.25E+05	8.00	1.25E+05	8.00	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999664
7.22.36.3	SIGNALLING - DCS TYPE 9	HARD DRIVE-600GB 6G 10K SFF SAS G8/G9	4	1.25E+06	0.80	3.13E+05	3.20	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999966
7.22.36.4	SIGNALLING - DCS TYPE 9	PBA-NIC 10/100/1000 PCI-E 4-PORT G8/G9	1	2.46E+05	4.07	2.46E+05	4.07	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999829
7.22.36.5	SIGNALLING - DCS TYPE 9	PC-PROL DL380 G9 E5-2620 2.4GHZ 16GB 2U	1	1.07E+05	9.37	1.07E+05	9.37	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999607
7.23	SIGNALLING AP SM NETWORK	ASSEMBLY-AP SM NETWORK	101	4.44E+04	22.54	4.39E+02	2276.13									1.00000000
7.23.1	SIGNALLING - AP SM NETWORK	ASSY-WRU WITH BANDPASS FILTER PAINTED MM	1	7.10E+04	14.08	7.10E+04	14.08									1.00000000
7.23.1.1	SIGNALLING - AP SM NETWORK	CBTC RADIO 1964500-901	1	6.58E+05	1.52	6.58E+05	1.52	OEM Data	0.25	0.05	0.05	0.10	0.00	0.05	0.50	0.99999924

OLR-05-0-0000-REP-0059	Interface Hazard Analysis	
Revision: 2	Date: 23 May 2019	Owner: M. Williamson

Ref.	System	Description	QPU	MTBF (hrs)	FR λ	Total MTBF	λ x QTY	Data Source	Logistic	Access	Isolation	Remove & Replace	Alignment	Test	TOTAL	Availability
7.23.1.2	SIGNALLING - AP SM NETWORK	PSU-DIN 100/240VAC IP 12VDC@4.5A OP 60W	1	3.50E+05	2.86	3.50E+05	2.86	OEM Data	0.25	0.05	0.05	0.10	0.00	0.05	0.50	0.99999857
7.23.1.3	SIGNALLING - AP SM NETWORK	TRANSCVR-MM LC DUP SFP 1000BASE-SX 2KM	2	3.79E+06	0.26	1.89E+06	0.53	OEM Data	0.25	0.05	0.05	0.10	0.00	0.05	0.50	0.99999987
7.23.1.4	SIGNALLING - AP SM NETWORK	FILTER-BANDPASS 8-POLE 2.40GHZ OUTDOOR	1	4.17E+06	0.24	4.17E+06	0.24	OEM Data	0.25	0.05	0.05	0.10	0.00	0.05	0.50	0.99999988
7.23.1.5	SIGNALLING - AP SM NETWORK	CABLE ASSY-COAX 600MM N-TYPE BH FM/ML RA	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.05	0.05	0.00	0.05	0.45	1.00000000
7.23.1.7	SIGNALLING - AP SM NETWORK	CABLE ASSY-COAX 460 MM N-TYPE ML/FML	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.05	0.05	0.00	0.05	0.45	1.00000000
7.23.1.8	SIGNALLING - AP SM NETWORK	CON-HOUSING BULKHEAD METAL HA 3/4 IP65	1	5.00E+08	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.05	0.05	0.00	0.05	0.45	1.00000000
7.23.2	SIGNALLING - AP SM NETWORK	ARRESTOR-LIGHTNING 50 OHM 3GHZ ML/FML	1	5.00E+07	0.02	5.00E+07	0.02	MIL-HDBK-217F	0.25	0.05	0.05	0.05	0.00	0.05	0.45	0.99999999
7.23.3	SIGNALLING - AP SM NETWORK	CON-COAX N-TYP ML LMR600 SPRING	2	2.00E+09	0.00	1.00E+09	0.00	MIL-HDBK-217F	0.25	0.05	0.05	0.05	0.00	0.05	0.45	1.00000000
7.23.4	SIGNALLING - AP SM NETWORK	CON-COAX N-TYP ML LMR400 PLUG SLDR	4	2.00E+09	0.00	5.00E+08	0.00	MIL-HDBK-217F	0.25	0.05	0.05	0.05	0.00	0.05	0.45	1.00000000
7.23.5	SIGNALLING - AP SM NETWORK	SPLITTER-2WAY 2.4GHZ 50 OHM 25W	1	5.00E+08	0.00	5.00E+08	0.00	OEM Data	0.25	0.05	0.05	0.05	0.00	0.05	0.45	1.00000000
7.23.6	SIGNALLING- AP SM NETWORK	ANTENNA-2.4GHZ ISM BAND 16DBI	2	3.03E+07	0.03	1.52E+07	0.07	Analogy to similar item	0.25	0.10	0.10	0.20	0.00	0.05	0.70	0.99999998
7.23.7	SIGNALLING- AP SM NETWORK	TERM BLOCK-4P 2-LVL 5.2MM FEEDTHRU PTTB	4	1.00E+10	0.00	2.50E+09	0.00	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.23.8	SIGNALLING - AP SM NETWORK	ADAPTER-F/O LC DUPLEX MULTI MODE	6	7.33E+05	1.37	1.22E+05	8.19	Analogy to similar item	0.25	0.10	0.02	0.05	0.00	0.05	0.47	0.99999936
7.23.9	SIGNALLING - AP SM NETWORK	TERM BLOCK-4P 2-LVL 5.2MM FEED THRU GRAY	15	1.00E+10	0.00	6.67E+08	0.00	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	1.00000000
7.23.10	SIGNALLING - AP SM NETWORK	SURGE PROTECTOR-230VAC 40KA TYPE 2L+ND	1	5.00E+07	0.02	5.00E+07	0.02	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	0.99999999
7.23.11	SIGNALLING - AP SM NETWORK	CIRCUIT BREAKER-2 POLE 2A 240VAC DIN	4	2.56E+07	0.04	6.41E+06	0.16	MIL-HDBK-217F	0.25	0.10	0.02	0.05	0.00	0.05	0.47	0.99999998
7.24	SIGNALLING - ATS RACK 1	RACK ASSEMBLY-ATS 1A-GENERIC	1	4.27E+03	234.43	4.27E+03	234.43									1.00000000
7.24.1	SIGNALLING - ATS RACK 1	PATCH PANEL-48 PORT RJ45 CAT5E SHIELD	1	3.16E+05	3.16	3.16E+05	3.16	Analogy to similar item	0.25	0.05	0.02	0.20	0.00	0.05	0.57	0.99999820
7.24.2	SIGNALLING - ATS RACK 1	PWR BAR-24-C13 6-C19 OUTLETS 32A VERT	2	2.56E+07	0.04	1.28E+07	0.08	Demonstrated field data	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999998
7.24.3	SIGNALLING - ATS RACK 1	CORD-PWR AC 12A/125V C14 TO NEMA5-15 2'	1	1.00E+09	0.00	1.00E+09	0.00	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.24.4	SIGNALLING - ATS RACK 1	CORD-PWR AC 10A/250V C13 C14 2.5M	15	1.00E+09	0.00	6.67E+07	0.02	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.24.5	SIGNALLING - ATS RACK 1	NETWORK SWITCH-24P+4G 10/100 MODULAR	1	1.00E+05	10.00	1.00E+05	10.00	Analogy to similar item	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999530
7.24.6	SIGNALLING - ATS RACK 1	TRANSCEIVER- SFP 100BASE-FX SM W/LC 20KM	8	7.33E+05	1.37	9.16E+04	10.92	Analogy to similar item	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999936
7.24.7	SIGNALLING - ATS RACK 1	MODULE-ETHERNET SW 10 PORT 8 SPF	1	5.50E+05	1.82	5.50E+05	1.82	OEM Data	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999915
7.24.8	SIGNALLING - ATS RACK 1	MODULE-FIREWALL 10P 10/100/1000	1	4.19E+04	23.85	4.19E+04	23.85	OEM Data	0.25	0.05	0.02	0.10	0.00	0.10	0.52	0.99998760
7.24.9	SIGNALLING - ATS RACK 1	PC ASSEMBLY-DATA RECORDER SERVER G9	1	2.68E+04	37.34	2.68E+04	37.34		0.25	0.05	0.02	0.10	0.00	0.10	0.52	0.99998059
7.24.10.1	SIGNALLING - ATS RACK 1	PSU-DL360/380 100/240VAC I/P 500W G9	1	3.50E+05	2.86	3.50E+05	2.86	Analogy to similar item	0.25	0.08	0.02	0.05	0.00	0.10	0.50	0.99999857
7.24.10.2	SIGNALLING - ATS RACK 1	DRIVE-DVD R/W INTERNAL SATA 9.5MM G9	1	1.25E+05	8.00	1.25E+05	8.00	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999624
7.24.10.3	SIGNALLING - ATS RACK 1	HARD DRIVE-600GB 6G 10K SFF SAS G8/G9	2	1.20E+06	0.83	6.00E+05	1.67	Analogy to similar item	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999961
7.24.10.4	SIGNALLING - ATS RACK 1	PBA-MEMORY 8GB DDR4-2133 RDIMM G9	2	6.17E+05	1.62	3.08E+05	3.24	Analogy to similar item	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999924
7.24.10.5	SIGNALLING - ATS RACK 1	PBA-NIC 10/100/1000PCI-E 4-PORT G8/G9	1	2.46E+05	4.07	2.46E+05	4.07	Analogy to similar item	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999809
7.24.10.6	SIGNALLING - ATS RACK 1	PC-PROL DL380 G9 E5-2620 2.4GHZ 16GB 2U	1	1.07E+05	9.37	1.07E+05	9.37	OEM Data	0.25	0.02	0.02	0.05	0.00	0.10	0.44	0.99999588
7.24.10.7	SIGNALLING - ATS RACK 1	ADAPTER-HOST BUS 82E FIBRE CHAN 2-PT MSA	2	2.46E+05	4.07	1.23E+05	8.13	Analogy to similar item	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999809
7.24.11	SIGNALLING - ATS RACK 1	MODULAR-SMART ARRAY P2000 G3 DUAL	1	3.37E+06	0.30	3.37E+06	0.30		0.25	0.05	0.02	0.10	0.00	0.10	0.52	0.99999985
7.24.12.	SIGNALLING - ATS RACK 1	HARD DRIVE-600GB 6G 15K DP SAS 3.5"	8	1.25E+06	0.80	1.56E+05	6.40	Demonstrated field data	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999962
7.24.13	SIGNALLING - ATS RACK 1	MODULE-SWITCH PSU 24-28VDC 30W DIN	1	5.50E+05	1.82	5.50E+05	1.82	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999924
7.24.14	SIGNALLING - ATS RACK 1	KEYBOARD-INTEGRATED MON 19" 2U DVI-D US	1	5.00E+04	20.00	5.00E+04	20.00	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999160
7.24.15	SIGNALLING - ATS RACK 1	KVM SWITCH-8PORT USB PS/2 1U RM	1	5.00E+05	2.00	5.00E+05	2.00	Demonstrated field data	0.25	0.05	0.02	0.08	0.00	0.05	0.45	0.99999910
7.24.16	SIGNALLING - ATS RACK 1	MODULE-8 PORT EXPANSION 10/100BASE-TX	3	1.00E+05	10.00	3.33E+04	30.00	Demonstrated field data	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999530
7.24.17	SIGNALLING - ATS RACK 1	PC ASSEMBLY-ATS SERVER G9	1	3.64E+04	27.49	3.64E+04	27.49		0.25	0.05	0.02	0.10	0.00	0.10	0.52	0.99998570
7.24.17.1	SIGNALLING - ATS RACK 1	PSU-DL360/380 100/240VAC I/P 500W G9	1	3.50E+05	2.86	3.50E+05	2.86	Analogy to similar item	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999866
7.24.17.2	SIGNALLING - ATS RACK 1	DRIVE-DVD R/W INTERNAL SATA 9.5MM G9	1	1.25E+05	8.00	1.25E+05	8.00	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999624
7.24.17.3	SIGNALLING - ATS RACK 1	HARD DRIVE-600GB 6G 10K SFF SAS G8/G9	4	1.25E+06	0.80	3.13E+05	3.20	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999962
7.24.17.4	SIGNALLING - ATS RACK 1	PBA-NIC 10/100/1000 PCI-E 4-PORT G8/G9	1	2.46E+05	4.07	2.46E+05	4.07	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999809
7.24.17.5	SIGNALLING - ATS RACK 1	PC-PROL DL380 G9 E5-2620 2.4GHZ 16GB 2U	1	1.07E+05	9.37	1.07E+05	9.37	OEM Data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999560
7.24.18	SIGNALLING - ATS RACK 1	PC ASSEMBLY-CA SERVER G9	1	4.58E+04	21.83	4.58E+04	21.83		0.25	0.05	0.02	0.10	0.00	0.10	0.52	0.99998865
7.24.18.1	SIGNALLING - ATS RACK 1	PSU-DL360/380 100/240VAC I/P 500W G9	1	3.50E+05	2.86	3.50E+05	2.86	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999866
7.24.18.2	SIGNALLING - ATS RACK 1	DRIVE-DVD R/W INTERNAL SATA 9.5MM G9	1	1.25E+05	8.00	1.25E+05	8.00	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999624
7.24.18.3	SIGNALLING - ATS RACK 1	HARD DRIVE-600GB 6G 10K SFF SAS G8/G9	2	1.25E+06	0.80	6.25E+05	1.60	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999962
7.24.18.4	SIGNALLING - ATS RACK 1	PC-PROL DL380 G9 E5-2620 2.4GHZ 16GB 2U	1	1.07E+05	9.37	1.07E+05	9.37	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999560

OLR-05-0-0000-REP-0059	Interface Hazard Analysis	
Revision: 2	Date: 23 May 2019	Owner: M. Williamson

Ref.	System	Description	QPU	MTBF (hrs)	FR λ	Total MTBF	λ x QTY	Data Source	Logistic	Access	Isolation	Remove & Replace	Alignment	Test	TOTAL	Availability
7.24.19	SIGNALLING - ATS RACK 1	UPS-SKVA 3.5KW O/P 208V 3U RM	1	1.07E+05	9.33	1.07E+05	9.33	OEM Data	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999562
7.24.20	SIGNALLING - ATS RACK 1	CABLE-PATCH CATSE UTP GRY 2M LSZH	38	5.00E+08	0.00	1.32E+07	0.08	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.24.21	SIGNALLING - ATS RACK 1	CABLE-UTP PATCH CORD CATSE GREY SM LSZH	16	5.00E+08	0.00	3.13E+07	0.03	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.24.22	SIGNALLING - ATS RACK 1	CABLE-CONSOLE USB TO 2.SMM PLUG	8	5.00E+08	0.00	6.25E+07	0.02	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.24.23	SIGNALLING - ATS RACK 1	CABLE-KVM SWITCH PS2/USB 9'	4	5.00E+08	0.00	1.25E+08	0.01	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.24.24	SIGNALLING - ATS RACK 1	CABLE ASSY-MINI SAS TO MINI SAS 6M G8	2	5.00E+08	0.00	2.50E+08	0.00	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.24.25	SIGNALLING - ATS RACK 1	CABLE-PATCH F/O SM DPX LC-SC 2M LSZH	3	5.00E+08	0.00	1.67E+08	0.01	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.24.26	SIGNALLING - ATS RACK 1	PANEL-PATCH FIBER 4-PORT 1U	1	2.23E+06	0.45	2.23E+06	0.45	Analogy to similar item	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999981
7.24.27	SIGNALLING - ATS RACK 1	PC ASSEMBLY-DATA RECORDER	1	3.64E+04	27.49	3.64E+04	27.49		0.25	0.05	0.02	0.10	0.00	0.10	0.52	0.99998570
7.24.27.1	SIGNALLING - ATS RACK 1	PSU-DL360/380 100/240VAC I/P S00W G9	1	3.50E+05	2.86	3.50E+05	2.86	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999866
7.24.27.2	SIGNALLING - ATS RACK 1	DRIVE-DVD R/W INTERNAL SATA 9.5MM G9	1	1.25E+05	8.00	1.25E+05	8.00	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999624
7.24.27.3	SIGNALLING - ATS RACK 1	HARD DRIVE-600GB 6G 10K SFF SAS G8/G9	4	1.25E+06	0.80	3.13E+05	3.20	Demonstrated field data	0.25	0.05	0.02	0.10	0.00	0.10	0.52	0.99999958
7.24.27.4	SIGNALLING - ATS RACK 1	PBA-NIC 10/100/1000 PCI-E 4-PORT G8/G9	1	2.46E+05	4.07	2.46E+05	4.07	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999809
7.24.27.5	SIGNALLING - ATS RACK 1	PC-PROL DL380 G9 ES-2620 2.4GHZ 16GB 2U	1	1.07E+05	9.37	1.07E+05	9.37	Demonstrated field data	0.25	0.05	0.02	0.10	0.00	0.10	0.52	0.99999513
7.24.28	SIGNALLING - ATS RACK 1	PLUG-AC 30A 250VAC NEMA L6-30R	1	1.00E+09	0.00	1.00E+09	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.10	0.00	0.05	0.47	1.00000000
7.25	SIGNALLING - ATS RACK 2	RACK ASSEMBLY-ATS 1B-GENERIC	1	3.75E+03	266.69	3.75E+03	266.69									1.00000000
7.25.1	SIGNALLING - ATS RACK 2	PATCH PANEL-48 PORT RJ45 CATSE SHIELD	1	3.16E+05	3.16	3.16E+05	3.16	Analogy to similar item	0.25	0.05	0.02	0.15	0.00	0.05	0.52	0.99999835
7.25.2	SIGNALLING - ATS RACK 2	PWR BAR-24-C13 6-C19 OUTLETS 32A VERT	2	2.56E+07	0.04	1.28E+07	0.08	Demonstrated field data	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999998
7.25.3	SIGNALLING - ATS RACK 2	CORD-PWR AC 12A/125V C14 TO NEMA5-15 2'	1	1.00E+09	0.00	1.00E+09	0.00	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.25.4	SIGNALLING - ATS RACK 2	CORD-PWR AC 10A/250V C13 C14 2.SM	14	1.00E+09	0.00	7.14E+07	0.01	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.25.5	SIGNALLING - ATS RACK 2	NETWORK SWITCH-24P+4G 10/100 MODULAR	1	1.00E+05	10.00	1.00E+0S	10.00	Analogy to similar item	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999530
7.25.6	SIGNALLING - ATS RACK 2	TRANSCEIVER- SFP 100BASE-FX SM W/LC 20KM	8	7.33E+05	1.37	9.16E+04	10.92	Analogy to similar item	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999936
7.25.7	SIGNALLING - ATS RACK 2	MODULE-ETHERNET SW 10 PORT 8 SPF	1	5.50E+05	1.82	5.50E+05	1.82	OEM Data	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999915
7.25.8	SIGNALLING - ATS RACK 2	MODULE-FIREWALL 10P 10/100/1000	1	4.19E+04	23.85	4.19E+04	23.85	OEM Data	0.25	0.05	0.02	0.10	0.00	0.10	0.52	0.99998760
7.25.9	SIGNALLING - ATS RACK 2	PC ASSEMBLY-DATA RECORDER SERVER	1	2.68E+04	37.34	2.68E+04	37.34		0.25	0.05	0.02	0.10	0.00	0.10	0.52	0.99998059
7.25.10.1	SIGNALLING - ATS RACK 2	PSU-100/240VAC I/P 460W 94% EFF G8 KIT	1	3.50E+05	2.86	3.50E+0S	2.86	Analogy to similar item	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999866
7.25.10.2	SIGNALLING - ATS RACK 2	DRIVE-DVD R/W INTERNAL SATA 12.7MM 2U G8	1	1.25E+05	8.00	1.25E+05	8.00	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999624
7.25.10.3	SIGNALLING - ATS RACK 2	HARD DRIVE-600GB 6G 10K SFF SAS G8/G9	2	1.20E+06	0.83	6.00E+05	1.67	Analogy to similar item	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999961
7.25.10.4	SIGNALLING - ATS RACK 2	PBA-MEMORY 8GB DDR3-1333 RDIMM G8	2	6.17E+05	1.62	3.08E+05	3.24	Analogy to similar item	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999924
7.25.10.5	SIGNALLING - ATS RACK 2	PBA-NIC 10/100/1000 PCI-E 4-PORT G8/G9	1	2.46E+05	4.07	2.46E+05	4.07	Analogy to similar item	0.25	0.05	0.02	0.10	0.00	0.10	0.52	0.99999789
7.25.10.6	SIGNALLING - ATS RACK 2	PC-PROL DL380p G8 E5-2630 2.3GHZ 16GB 2U	1	1.07E+05	9.37	1.07E+05	9.37	OEM Data	0.25	0.05	0.02	0.10	0.00	0.10	0.52	0.99999513
7.25.10.7	SIGNALLING - ATS RACK 2	ADAPTER-HOST BUS P2000 G3 SAS DL380 G8	2	2.46E+05	4.07	1.23E+05	8.13	Analogy to similar item	0.25	0.05	0.02	0.02	0.00	0.10	0.44	0.99999821
7.25.11	SIGNALLING - ATS RACK 2	MODULAR-SMART ARRAY P2000 G3 DUAL CNTRLR	1	3.37E+06	0.30	3.37E+06	0.30		0.25	0.05	0.02	0.10	0.00	0.10	0.52	0.99999985
7.25.12.	SIGNALLING - ATS RACK 2	HARD DRIVE-600GB 6G 15K DP SAS 3.5"	8	1.25E+06	0.80	1.56E+05	6.40	Demonstrated field data	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999962
7.25.13	SIGNALLING - ATS RACK 2	MODULE-SWITCH PSU 24-28VDC 30W DIN	1	5.50E+05	1.82	5.50E+05	1.82	OEM Data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999915
7.25.14	SIGNALLING - ATS RACK 2	KEYBOARD-INTEGRATED MON 19" 2U DVI-D US	1	5.00E+04	20.00	5.00E+04	20.00	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999160
7.25.15	SIGNALLING - ATS RACK 2	KVM SWITCH-8PORT USB PS/2 1U RM	1	5.00E+05	2.00	5.00E+05	2.00	Demonstrated field data	0.25	0.05	0.02	0.08	0.00	0.05	0.45	0.99999910
7.25.16	SIGNALLING - ATS RACK 2	MODULE-8 PORT EXPANSION 10/100BASE-TX	3	1.00E+05	10.00	3.33E+04	30.00	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999580
7.25.17	SIGNALLING - ATS RACK 2	PC ASSEMBLY-ATS SERVER	1	3.64E+04	27.49	3.64E+04	27.49		0.25	0.05	0.02	0.10	0.00	0.10	0.52	0.99998570
7.25.17.1	SIGNALLING - ATS RACK 2	PSU-100/240VAC I/P 460W 94% EFF G8 KIT	1	3.50E+05	2.86	3.50E+05	2.86	Analogy to similar item	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999866
7.25.17.2	SIGNALLING - ATS RACK 2	DRIVE-DVD R/W INTERNAL SATA 12.7MM 2U G8	1	1.25E+05	8.00	1.25E+05	8.00	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999624
7.25.17.3	SIGNALLING - ATS RACK 2	HARD DRIVE-600GB 6G 10K SFF SAS G8/G9	4	1.25E+06	0.80	3.13E+05	3.20	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999962
7.25.17.4	SIGNALLING - ATS RACK 2	PBA-NIC 10/100/1000 PCI-E 4-PORT G8/G9	1	2.46E+05	4.07	2.46E+05	4.07	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999809
7.25.17.5	SIGNALLING - ATS RACK 2	PC-PROL DL380p G8 E5-2630 2.3GHZ 16GB 2U	1	1.07E+05	9.37	1.07E+05	9.37	OEM Data	0.25	0.05	0.02	0.10	0.00	0.10	0.52	0.99999513
7.25.18	SIGNALLING - ATS RACK 2	PC ASSEMBLY-DIAGNOSTIC SERVER	1	3.57E+04	28.03	3.57E+04	28.03		0.25	0.05	0.02	0.10	0.00	0.10	0.52	0.99998543
7.25.19.1	SIGNALLING - ATS RACK 2	PSU-100/240VAC I/P 460W 94% EFF G8 KIT	1	3.50E+0S	2.86	3.50E+05	2.86	Analogy to similar item	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999866
7.25.19.2	SIGNALLING - ATS RACK 2	DRIVE-DVD R/W INTERNAL SATA 12.7MM 2U G8	1	1.25E+05	8.00	1.25E+05	8.00	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999624
7.25.19.3	SIGNALLING - ATS RACK 2	HARD DRIVE-600GB 6G 10K SFF SAS G8/G9	4	1.25E+06	0.80	3.13E+05	3.20	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999962
7.25.19.4	SIGNALLING - ATS RACK 2	PBA-NIC 10/100/1000 PCI-E 4-PORT G8/G9	1	2.46E+05	4.07	2.46E+05	4.07	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999809
7.25.19.5	SIGNALLING - ATS RACK 2	PC-PROL DL380p G8 ES-2630 2.3GHZ 16GB 2U	1	1.07E+05	9.37	1.07E+05	9.37	OEM Data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999560

Ref.	System	Description	QPU	MTBF (hrs)	FR A	Total MTBF	A x QTY	Data Source	Logistic	Access	Isolation	Remove & Replace	Alignment	Test	TOTAL	Availability
7.25.19.6	SIGNALLING - ATS RACK 2	PROCESSOR KIT-DL380P ES-2630 HEX 2.3GHZ	1	1.87E+06	0.54	1.87E+06	0.54	OEM Data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999975
7.25.20	SIGNALLING - ATS RACK 2	UPS-SKVA 3.5KW O/P 208V 3U RM	1	1.07E+05	9.33	1.07E+05	9.33	OEM Data	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999562
7.25.21	SIGNALLING - ATS RACK 2	CABLE-PATCH CATSE UTP GRY 2M LSZH	39	5.00E+08	0.00	1.28E+07	0.08	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.25.22	SIGNALLING - ATS RACK 2	CABLE-UTP PATCH CORD CATSE GREY SM LSZH	14	5.00E+08	0.00	3.57E+07	0.03	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.25.23	SIGNALLING - ATS RACK 2	PC ASSY-BKP/DR/SNOOPER SVR (ODTT)	1	2.88E+04	34.76	2.88E+04	34.76		0.25	0.05	0.02	0.10	0.00	0.10	0.52	0.99998193
7.25.23.1	SIGNALLING - ATS RACK 2	PSU-100/240VAC I/P 460W 94% EFF G8 KIT	1	3.50E+05	2.86	3.50E+05	2.86	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999866
7.25.23.2	SIGNALLING - ATS RACK 2	DRIVE-DVD R/W INTERNAL SATA 12.7MM 2U G8	1	1.25E+05	8.00	1.25E+05	8.00	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999624
7.25.23.3	SIGNALLING - ATS RACK 2	HARD DRIVE-600GB 6G 10K SFF SAS G8/G9	8	1.25E+06	0.80	1.56E+0S	6.40	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999962
7.25.23.4	SIGNALLING - ATS RACK 2	PBA-NIC 10/100/1000 PCI-E 4-PORT G8/G9	2	2.46E+0S	4.07	1.23E+05	8.13	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999809
7.25.23.5	SIGNALLING - ATS RACK 2	PC-PROL DL380p G8 ES-2630 2.3GHZ 16GB 2U	1	1.07E+0S	9.37	1.07E+05	9.37	Demonstrated field data	0.25	0.05	0.02	0.10	0.00	0.10	0.52	0.99999513
7.25.24	SIGNALLING - ATS RACK 2	CABLE-CONSOLE USB TO 2.5MM PLUG	1	5.00E+08	0.00	5.00E+08	0.00	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.25.25	SIGNALLING - ATS RACK 2	CABLE-KVM SWITCH PS2/USB 9'	4	5.00E+08	0.00	1.25E+08	0.01		0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.25.26	SIGNALLING - ATS RACK 2	CABLE ASSY-MINI SAS TO MINI SAS 6M G8	2	5.00E+08	0.00	2.50E+08	0.00	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.25.27	SIGNALLING - ATS RACK 2	CABLE-PATCH F/O SM DPX LC-SC 2M LSZH	8	5.00E+08	0.00	6.25E+07	0.02	Demonstrated field data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	1.00000000
7.25.28	SIGNALLING - ATS RACK 2	PANEL-FIBER COUPLER SM 6 SC DUPLEX	4	2.13E+0S	4.70	5.32E+04	18.80	Analogy to similar item	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999803
7.25.29	SIGNALLING - ATS RACK 2	PLUG-AC 30A 250VAC NEMA L6-30R	1	1.00E+09	0.00	1.00E+09	0.00	MIL-HDBK-217F	0.25	0.05	0.02	0.10	0.00	0.05	0.47	1.00000000
7.25.30	SIGNALLING - ATS RACK 2	PANEL-PATCH FIBER 4-PORT 1U	1	2.23E+06	0.45	2.23E+06	0.45	OEM Data	0.25	0.05	0.02	0.05	0.00	0.05	0.42	0.99999981
7.26	SIGNALLING - Workstation	PC ASSEMBLY-ATS WORKSTATION	12	5.29E+04	18.89	4.41E+03	226.73		0.25	0.05	0.02	0.15	0.00	0.10	0.57	0.99998923
7.26.1.1	SIGNALLING - Workstation	PC-WORKSTATION Z420 QC 2.8GHZ 4GB 500GB	1	9.80E+04	10.20	9.80E+04	10.20	Analogy to similar item	0.25	0.05	0.02	0.10	0.00	0.10	0.52	0.99999470
7.26.1.2	SIGNALLING - Workstation	PBA-NIC PCIe GIGABIT Z420/Z440 DUAL	2	2.46E+0S	4.07	1.23E+0S	8.13	OEM Data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999809
7.26.1.3	SIGNALLING - Workstation	PBA-GRAPHIC PCIE 1024MB DUAL HEAD LP	1	1.79E+06	0.56	1.79E+06	0.56	Analogy to similar item	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999974
7.26.2	SIGNALLING - Workstation	PC ASSEMBLY-TNMS/UNMS/TRN WORKSTATION	2	6.50E+04	15.39	3.25E+04	30.77		0.25	0.05	0.02	0.15	0.00	0.10	0.57	0.99999123
7.26.2.1	SIGNALLING - Workstation	PC-WORKSTATION Z420 QC 2.8GHZ 4GB 500GB	1	9.80E+04	10.20	9.80E+04	10.20	Analogy to similar item	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999521
7.26.2.2	SIGNALLING - Workstation	PBA-NIC PCIe GIGABIT Z420/Z440 DUAL	1	2.46E+0S	4.07	2.46E+05	4.07	OEM Data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999809
7.26.2.3	SIGNALLING - Workstation	PBA-GRAPHIC PCIE 1024MB DUAL HEAD LP	2	1.79E+06	0.56	8.93E+05	1.12	Analogy to similar item	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999974
7.26.3	SIGNALLING - Workstation	PC ASSEMBLY-MIMIC WORKSTATION	2	5.45E+04	18.33	2.73E+04	36.67		0.25	0.05	0.02	0.15	0.00	0.10	0.57	0.99998955
7.26.3.1	SIGNALLING - Workstation	PC-WORKSTATION Z420 QC 2.8GHZ 4GB 500GB	1	9.80E+04	10.20	9.80E+04	10.20	Analogy to similar item	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999521
7.26.3.2	SIGNALLING - Workstation	PBA-NIC PCIe GIGABIT Z420/Z440 DUAL	1	2.46E+05	4.07	2.46E+0S	4.07	OEM Data	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999809
7.26.3.3	SIGNALLING - Workstation	PBA-GRAPHIC PCIe 2GB NVS 510 QUAD HEAD	1	2.46E+0S	4.07	2.46E+0S	4.07	Analogy to similar item	0.25	0.05	0.02	0.05	0.00	0.10	0.47	0.99999809
7.26.4	SIGNALLING - Workstation	PRINTER-COLOR LASERJET 600DPI 30PPM 110V	2	5.00E+04	20.00	2.50E+04	40.00	Analogy to similar item	0.25	0.05	0.02	0.25	0.00	0.10	0.67	0.99998660
7.26.5	SIGNALLING - Workstation	MONITOR-24" LED 1920x1080 16:9 300NITS	26	2.63E+05	3.81	1.01E+04	98.93	Analogy to similar item	0.25	0.05	0.02	0.10	0.00	0.05	0.47	0.99999821

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APPENDIX D – FMEA WORKSHEETS

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7.16.15.2	SIGNALLING-RELAY RACK ASSEMBLY	TERMINAL BLOCK-M4/8.SF RM GREY	CBTC PROCESSING AND CONTROL FUNCTIONS	LOSS OF FUNCTION	OPEN/SHORT CCT, HARDWARE FAILURE	DEGRADED CBTC FUNCTION	NO OPERATIONAL EFFECT	REDUNDANT HARDWARE	NONE	SIGNALLING ERROR MESSAGE	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.16.15.3	SIGNALLING RELAY RACK ASSEMBLY	FUSE LINK 1A 250V 5X20MM	CBTC PROCESSING AND CONTROL FUNCTIONS	LOSS OF FUNCTION	OPEN/SHORT CCT, HARDWARE FAILURE	DEGRADED CBTC FUNCTION	NO OPERATIONAL EFFECT	REDUNDANT HARDWARE	NONE	SIGNALLING ERROR MESSAGE	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.16.15.4	SIGNALLING - RELAY RACK ASSEMBLY	CON-INSERT 42 PIN HAN DD FML	CBTC PROCESSING AND CONTROL FUNCTIONS	LOSS OF FUNCTION	OPEN/SHORT CCT, HARDWARE FAILURE	DEGRADED CBTC FUNCTION	NO OPERATIONAL EFFECT	REDUNDANT HARDWARE	NONE	SIGNALLING ERROR MESSAGE	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.16.15.5	SIGNALLING-RELAY RACK ASSEMBLY	RELAY-VITAL TYPE B1 4FB-2F-1B 7.5VDC	CBTC PROCESSING AND CONTROL FUNCTIONS	LOSS OF FUNCTION	OPEN/SHORT CCT, HARDWARE FAILURE	DEGRADED CBTC FUNCTION	NO OPERATIONAL EFFECT	REDUNDANT HARDWARE	NONE	SIGNALLING ERROR MESSAGE	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.16.15.6	SIGNALLING-RELAY RACK ASSEMBLY	PLUGBOARD-TYPE B1 RELAY 16-20AWG CRIMP	CBTC PROCESSING AND CONTROL FUNCTIONS	LOSS OF FUNCTION	OPEN/SHORT CCT, HARDWARE FAILURE	DEGRADED CBTC FUNCTION	NO OPERATIONAL EFFECT	REDUNDANT HARDWARE	NONE	SIGNALLING ERROR MESSAGE	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.16.16	SIGNALLING RELAY RACK ASSEMBLY	RACK ASSY RELAY ZC5 RR3	CBTC PROCESSING AND CONTROL FUNCTIONS	LOSS OF FUNCTION	OPEN/SHORT CCT, HARDWARE FAILURE	DEGRADED CBTC FUNCTION	NO OPERATIONAL EFFECT	REDUNDANT HARDWARE	NONE	SIGNALLING ERROR MESSAGE	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.16.16.1	SIGNALLING-RELAY RACK ASSEMBLY	TERM BLOCK-M4/6.SNB RM GREY-ORG (ROHS)	CBTC PROCESSING AND CONTROL FUNCTIONS	LOSS OF FUNCTION	OPEN/SHORT CCT, HARDWARE FAILURE	DEGRADED CBTC FUNCTION	NO OPERATIONAL EFFECT	REDUNDANT HARDWARE	NONE	SIGNALLING ERROR MESSAGE	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.16.16.2	SIGNALLING-RELAY RACK ASSEMBLY	TERMINAL BLOCK-M4/8.SF RM GREY	CBTC PROCESSING AND CONTROL FUNCTIONS	LOSS OF FUNCTION	OPEN/SHORT CCT, HARDWARE FAILURE	DEGRADED CBTC FUNCTION	NO OPERATIONAL EFFECT	REDUNDANT HARDWARE	NONE	SIGNALLING ERROR MESSAGE	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.16.16.3	SIGNALLING-RELAY RACK ASSEMBLY	FUSE LINK-1A 250V 5X20MM	CBTC PROCESSING AND CONTROL FUNCTIONS	LOSS OF FUNCTION	OPEN/SHORT CCT, HARDWARE FAILURE	DEGRADED CBTC FUNCTION	NO OPERATIONAL EFFECT	REDUNDANT HARDWARE	NONE	SIGNALLING ERROR MESSAGE	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.16.16.4	SIGNALLING - RELAY RACK ASSEMBLY	CON-INSERT 42 PIN HAN DD FML	CBTC PROCESSING AND CONTROL FUNCTIONS	LOSS OF FUNCTION	OPEN/SHORT CCT, HARDWARE FAILURE	DEGRADED CBTC FUNCTION	NO OPERATIONAL EFFECT	REDUNDANT HARDWARE	NONE	SIGNALLING ERROR MESSAGE	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.16.16.5	SIGNALLING RELAY RACK ASSEMBLY	RELAY-VITAL TYPE B1 4FB-2F-1B 7.5VDC	CBTC PROCESSING AND CONTROL FUNCTIONS	LOSS OF FUNCTION	OPEN/SHORT CCT, HARDWARE FAILURE	DEGRADED CBTC FUNCTION	NO OPERATIONAL EFFECT	REDUNDANT HARDWARE	NONE	SIGNALLING ERROR MESSAGE	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.16.16.6	SIGNALLING - RELAY RACK ASSEMBLY	RELAY-VITAL TYPE B1 0.0157A 6FB 30-220V	CBTC PROCESSING AND CONTROL FUNCTIONS	LOSS OF FUNCTION	OPEN/SHORT CCT, HARDWARE FAILURE	DEGRADED CBTC FUNCTION	NO OPERATIONAL EFFECT	REDUNDANT HARDWARE	NONE	SIGNALLING ERROR MESSAGE	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.16.16.7	SIGNALLING - RELAY RACK ASSEMBLY	PLUGBOARD-TYPE B1 RELAY 16-20AWG CRIMP	CBTC PROCESSING AND CONTROL FUNCTIONS	LOSS OF FUNCTION	OPEN/SHORT CCT, HARDWARE FAILURE	DEGRADED CBTC FUNCTION	NO OPERATIONAL EFFECT	REDUNDANT HARDWARE	NONE	SIGNALLING ERROR MESSAGE	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.16.16.8	SIGNALLING-RELAY RACK ASSEMBLY	RELAY-DPDT 8A 12VDC DIN MOUNT	CBTC PROCESSING AND CONTROL FUNCTIONS	LOSS OF FUNCTION	OPEN/SHORT CCT, HARDWARE FAILURE	DEGRADED CBTC FUNCTION	NO OPERATIONAL EFFECT	REDUNDANT HARDWARE	NONE	SIGNALLING ERROR MESSAGE	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.16.16.9	SIGNALLING-RELAY RACK ASSEMBLY	RELAY-DPDT 8A 120VAC DIN MOUNT	CBTC PROCESSING AND CONTROL FUNCTIONS	LOSS OF FUNCTION	OPEN/SHORT CCT, HARDWARE FAILURE	DEGRADED CBTC FUNCTION	NO OPERATIONAL EFFECT	REDUNDANT HARDWARE	NONE	SIGNALLING ERROR MESSAGE	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.17	SIGNALLING-DCS TYPE 1A	RACK ASSEMBLY-DCS TYPE 1A-GENERIC	CBTC PROCESSING AND CONTROL FUNCTIONS	LOSS OF FUNCTION	OPEN/SHORT CCT, HARDWARE FAILURE	DEGRADED CBTC FUNCTION	NO OPERATIONAL EFFECT	REDUNDANT HARDWARE	NONE	SIGNALLING ERROR MESSAGE	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.17.1	SIGNALLING - DCS TYPE 1A	PWR BAR-30-C13 6-C19 OUTLETS 32A VERT	CBTC PROCESSING AND CONTROL FUNCTIONS	LOSS OF FUNCTION	OPEN/SHORT CCT, HARDWARE FAILURE	DEGRADED CBTC FUNCTION	NO OPERATIONAL EFFECT	REDUNDANT HARDWARE	NONE	SIGNALLING ERROR MESSAGE	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.17.2	SIGNALLING - DCS TYPE 1A	PATCH PANEL-48 PORT RJ45 CAT5E SHIELD	CBTC PROCESSING AND CONTROL FUNCTIONS	LOSS OF FUNCTION	OPEN/SHORT CCT, HARDWARE FAILURE	DEGRADED CBTC FUNCTION	NO OPERATIONAL EFFECT	REDUNDANT HARDWARE	NONE	SIGNALLING ERROR MESSAGE	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7.17.3	SIGNALLING-DCS TYPE 1A	PANEL-FIBER COUPLER SM 6 SC DUPLEX	CBTC PROCESSING AND CONTROL FUNCTIONS	LOSS OF FUNCTION	OPEN/SHORT CCT, HARDWARE FAILURE	DEGRADED CBTC FUNCTION	NO OPERATIONAL EFFECT	REDUNDANT HARDWARE	NONE	SIGNALLING ERROR MESSAGE	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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END	SYSTEM	DESCRIPTION	FUNCTION	FAILURE MODE	CAUSE	END EFFECT	OPERATIONAL EFFECT	DESIGN MITIGATION	OPERATING MITIGATION	DETECTION METHOD	CORRECTIVE DOWNTIME (HR/YR)	PREVENTIVE DOWNTIME (/YR)	TOTAL DOWNTIME (/YR)	SERVICES DELAYED PER YEAR
[redacted]														

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APPENDIX E – RELIABILITY BLOCK DIAGRAMS

Line Route RBD

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TVS RBD

MSF CTS RBD

Station RBD

TPSS RBD

OCS RBD