

EPS PowerCare™ Management System Overview

This document has been prepared to present a general overview of the repair, overhaul, and contract management database used as part of EPS's PowerCare™ Turbine package management tool. The product has been specifically tailored to provide accurate management utilities to support complex package maintenance arrangements, where multiple systems are contained within the agreement scope of supply.

PowerCare™ uses the database to generate a comprehensive inventory of all elements of a package so that a complete schedule can be prepared for the timely maintenance of each component in the system. This ensures optimum system availability at a fully predictable cost and risk level. This is backed up with a suite of tools that support real-time monitoring and trending so that unexpected outages can be minimised.

PowerCare™ also uses the database to generate a fully documented work-to manual based on its catalogue of standard maintenance procedures for most of the common components used within the Industry. The outcome of this is a fully audited maintenance process that can be used to satisfy any QA requirements.

Like all database products the system is reliant upon accurate data input and accurate maintenance of the installed data. EPS has gone to great lengths to simplify the system in such a way that data management is as easy for the operator as possible whilst ensuring system integrity and security. Data audits can be readily carried out with bolt on management modules.

The advantage of having rapid access to detailed component data has obvious advantages when considering component life, replacement or overhaul data, stock control, component history and cost control.

The data required is initially recovered from a survey of the customer's equipment. This is an ongoing process during the early months of the agreement where survey data is confirmed and new data is added. The objective is to identify every device that falls within the scope of cover agreed. Details such as manufacturer, supplier, local agent, cost, parts data, and maintenance requirements are all recovered. EPS see this period as the initial investment period that will allow efficient and accurate daily management of a support agreement and hence allows us to deliver a quality service to the customer.

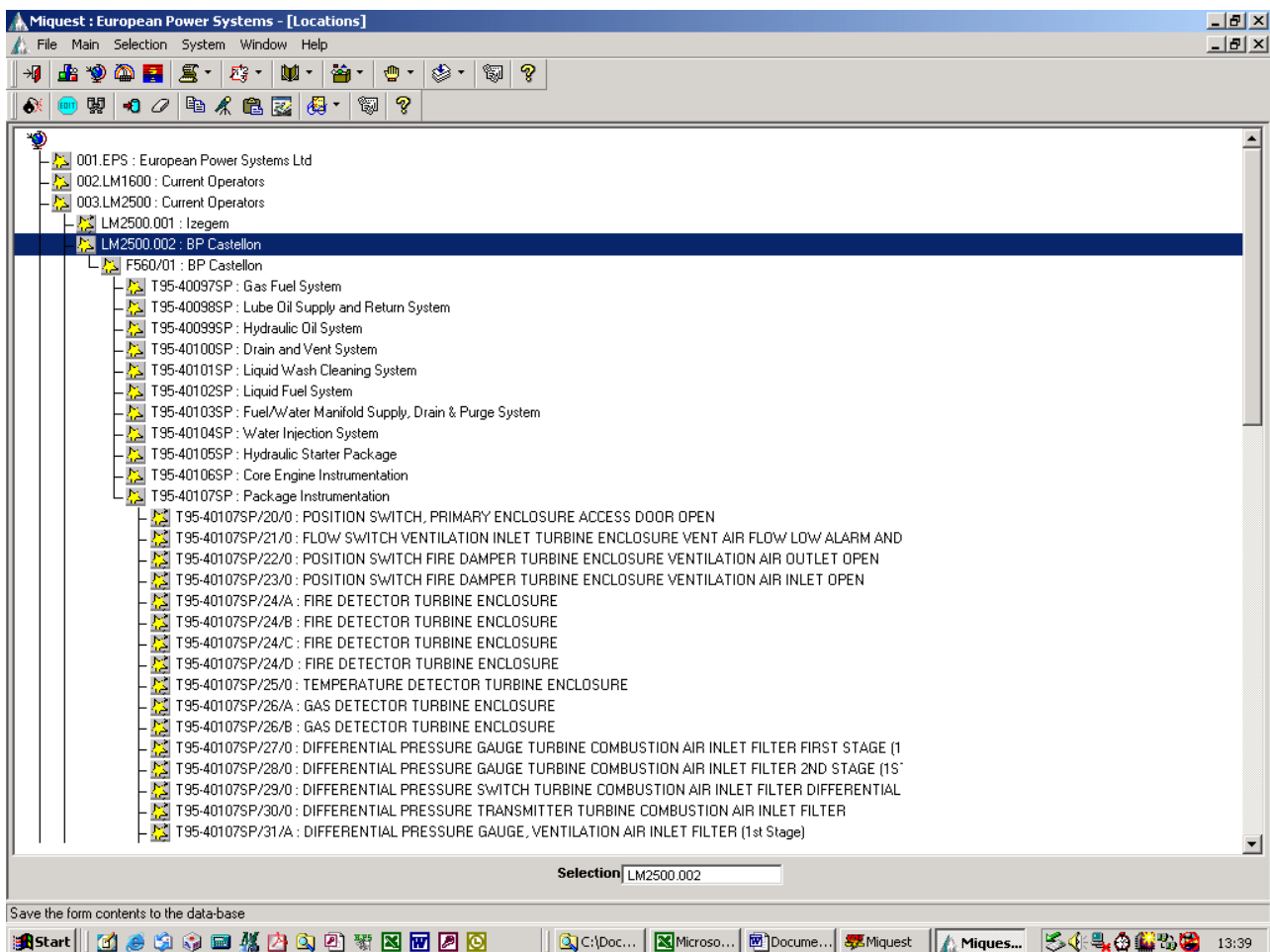
The database is constructed around a hierarchical windows based structure, in which each key area has folders containing supporting sub folders. The result of this is a very simple structure that closely mimics current accepted industry standards in data management.

In order to understand the full functionality of the database system we have broken the key functions of Gas Turbine contract management down into their respective fields and explained how our Database controls each requirement.

- **Main Agreement Document**, this is where the full scope of services to be provided are detailed with maintenance, limits of responsibility, terms and conditions, pricing and cost escalations,

annexes such as tag numbers covered within the contract and to what level that component is supported. Other maintenance provider contracts generally offer a blanket coverage to a certain level, we have the ability to offer contracts where components or sub systems are covered to different levels on the same package thereby offering the customer increased flexibility in pricing.

- **Drawing Location References**, here each component on the package is identified with a reference number (references are all taken from OE site drawings issued with original documentation – P&ID's). This represents, depending on site configuration, approximately 500 components per package. These components are used in the database as location references (or folders / sub folders using windows terminology), these will be structured in the following sequence: Engine Type, Customer, Gas Turbine (there may be more than one per site), sub system (fuel, Lube oil, instrumentation etc), item identification number from that system drawing – Location Ref. Manufacturers details, part numbers, serial numbers, individual component hours run since installation (the counters detailed later in this document), suppliers and costs will all be associated with this location reference. Each location reference has a contractual level of support associated with it based on the scope of supply in the main service support agreement. The EPS system operator can then instantly see the level of component support and hence his/her obligations.



Device Location Structure – BP LM2500

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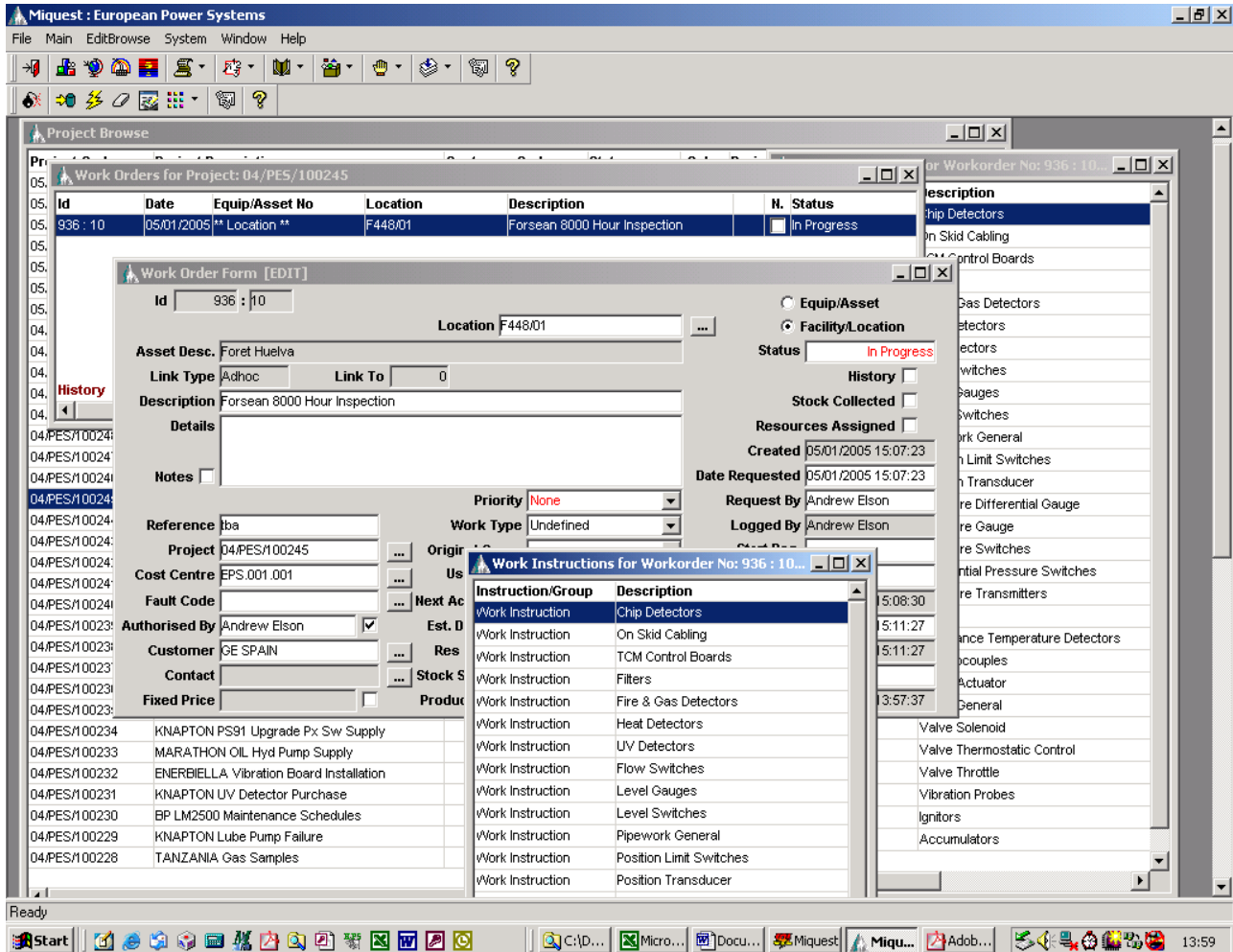
Unit 4 Technology Centre, Epinal Way, Loughborough, Leicestershire, LE11 3GE, United Kingdom
Company Number 4359653. VAT Number GB 789 3342 82.

- **Tag Numbers**, these are additional identification aids to the site drawings, these are well recognised locations which supplement the full location ident with more user friendly terminology. The system can identify specific data with a filter on either form of identifier.
- **Commercial**, here we can see the income and expenditure of the contract detailed to clearly show amongst others component changes and man-hours consumed. In effect it is a current account listing that will give us an accurate snapshot of the traffic of monies at any one time. Component changes should automatically update income and expenditure sheets depending on the level of component cover. Please note that this is an internal facility that EPS generally do not disclose to the client.
- **Suppliers**, details of component manufacturers, there contact references and alternative providers.
- **Event Register**, all problems/breakdowns will be given an initial reference number thus logging the problem into the system. First line fault diagnosis can then be carried out, normally this takes the form of simple system checks to be carried out by the turbine operatives. Events that have been closed can be archived, leaving all outstanding events clearly visible, this ensures no loss of focus on events in progress.
- **Projects**, if an event requires further remedial work, or site attendance by EPS a project reference is raised which will act as a cost capturing reference number. All spare part supplies, manpower, outgoing purchase orders and incoming invoices can then be associated with a specific project, allowing costs to be closely monitored as the job progresses.

Project Code	Project Description	Customer Code	Status	Subs	Project Type Code	Asset Cod
05/PES/100260	TVP HMI Upgrade	TVPL 01	New In	<input type="checkbox"/>	Engineering Retrofit	
05/PES/100259	Dubai Thermocouple Problem	WGLIT	New In	<input type="checkbox"/>	Unscheduled Maintenance	
05/PES/100258	Aiscondel Fuel System Checks	STANDARD 01	New In	<input type="checkbox"/>	Scheduled Maintenance	
05/PES/100257	Siemens Telephone Support	SIEMENS 02	New In	<input type="checkbox"/>	Management	
05/PES/100256	Knaption TSA	TCT 01	New In	<input type="checkbox"/>	Scheduled Maintenance	
05/PES/100255	TVP LTSA	VOLVO AERO 01	New In	<input type="checkbox"/>	LTSA	
05/PES/100254	EPS Operating Expenditure 2005		New In	<input type="checkbox"/>	To be determined	
04/PES/100253	TVP Package Training Course	TVPL 01	New In	<input type="checkbox"/>	Training	
04/PES/100252	TVP T48 Harness Repair	VOLVO AERO 01	New In	<input type="checkbox"/>	Asset Overhaul	
04/PES/100251	Enerbiella Typhoon Starting Problems	ENERBIELLA	New In	<input type="checkbox"/>	Unscheduled Maintenance	
04/PES/100250	EcoCarburantes Vibration Fault		New In	<input type="checkbox"/>	Unscheduled Maintenance	
04/PES/100249	WGLIT Overspeed Board Repair	WGLIT	New In	<input type="checkbox"/>	Asset Overhaul	
04/PES/100248	Aiscondel Starting Problems	SIEMENS 02	New In	<input type="checkbox"/>	Unscheduled Maintenance	
04/PES/100247	Knaption Off Skid B&V Valve Replacement	KNAPTON-02	New In	<input type="checkbox"/>	Spares Sale	
04/PES/100246	Knaption Anti Icing Modification	KNAPTON-02	New In	<input type="checkbox"/>	Engineering Retrofit	
04/PES/100245	Forsean 8000 Hour Inspection	GE SPAIN	In Progress	<input type="checkbox"/>	Scheduled Maintenance	
04/PES/100244	Enerbiella Flying Lead Replacement	VOLVO AERO 01	New In	<input type="checkbox"/>	Unscheduled Maintenance	
04/PES/100243	TVP Modem Installation	TVPL 01	New In	<input type="checkbox"/>	Engineering Retrofit	
04/PES/100242	TVP T48 Harness Repair	VOLVO AERO 01	New In	<input type="checkbox"/>	Asset Overhaul	
04/PES/100241	Silkeborg Staging Problems	SILKEBORG 01	New In	<input type="checkbox"/>	Unscheduled Maintenance	
04/PES/100240	Teeside P48 Fault	TCT 01	New In	<input type="checkbox"/>	Unscheduled Maintenance	
04/PES/100239	Huelva Package Problems	GE SPAIN	New In	<input type="checkbox"/>	Unscheduled Maintenance	
04/PES/100238	Enerbiella Vibration System Problems	VOLVO AERO 01	New In	<input type="checkbox"/>	Unscheduled Maintenance	
04/PES/100237	BP LM2500 VSV Overhaul		New In	<input checked="" type="checkbox"/>	Asset Overhaul	
04/PES/100236	BP LM2500 Island Mode Rationisation		New In	<input type="checkbox"/>	Engineering Retrofit	
04/PES/100235	KNAPTON NOX Mapping		New In	<input type="checkbox"/>	Scheduled Maintenance	
04/PES/100234	KNAPTON PS91 Upgrade Px Sw Supply		New In	<input type="checkbox"/>	Spares Sale	
04/PES/100233	MARATHON OIL Hyd Pump Supply		New In	<input type="checkbox"/>	Spares Sale	
04/PES/100232	ENERBIELLA Vibration Board Installation		New In	<input type="checkbox"/>	Scheduled Maintenance	
04/PES/100231	KNAPTON UV Detector Purchase		New In	<input type="checkbox"/>	Spares Sale	
04/PES/100230	BP LM2500 Maintenance Schedules		New In	<input type="checkbox"/>	Scheduled Maintenance	
04/PES/100229	KNAPTON Lube Pump Failure		New In	<input type="checkbox"/>	Unscheduled Maintenance	
04/PES/100228	TANZANIA Gas Samples		New In	<input type="checkbox"/>	Scheduled Maintenance	

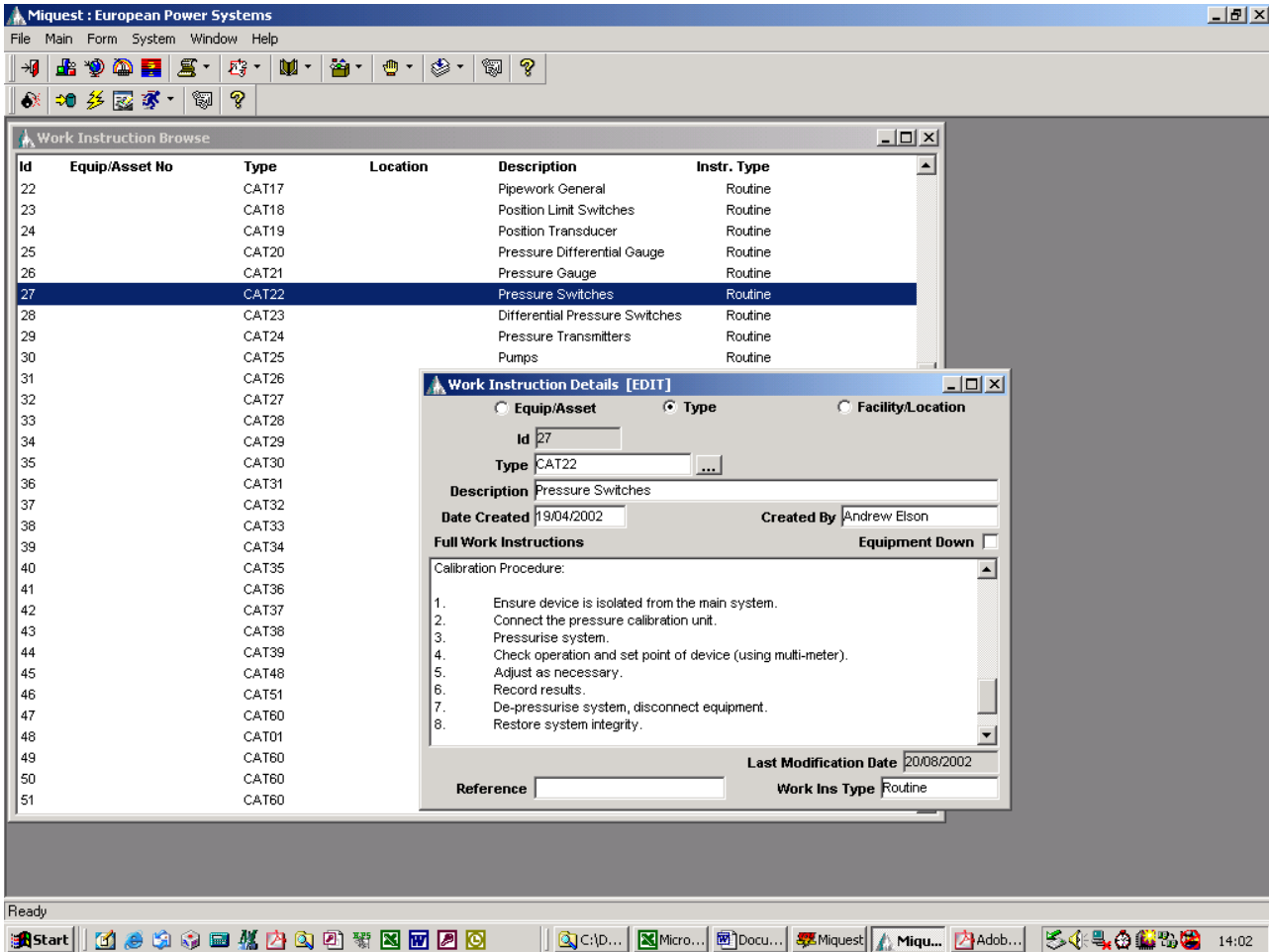
Project folder structure example.

- **Work Orders.** Site work that requires the attendance of an EPS engineer is requested through a Work order, which is raised against a specific project. All installed components registered as a location on the system, requiring remedial will have a work order raised against it. This work order contains all instructions relating to the fault, spares required, manpower allocations, component history and all costs to date. A current list of all outstanding work orders against any component or system or site can be generated at any time.



EPS Work Order and associated technical instruction example.

- **Technical Instructions,** these describe how the field engineer is to carry out certain technical procedures. Specific technical procedures for the required workscope can be attached to each work order from a central technical instruction register. The instruction ensures that procedures are completed in the same manner and importantly to the same standard each time they are carried out irrespective of the engineer attending site. The instructions are subject to constant review and controlled amendment.



EPS Technical Instruction example.

- **Event/Work Order/Project Archives**, these sections detail events that have been completed and closed. A key strength of the system is not being able to archive an event unless all elements of the task have been completed. i.e. all invoices have been generated and parts/services despatched.
- **Contract Stock**, all spares that are either customer or EPS owned or customer specific are controlled by the system. Stock may be held on the customer's site, or contractors facilities, the system naturally lends itself to the ability to offer shared stock support whereby operators of similar equipment in similar locations have the benefit of shared spares support with the advantage of reduced costs in materials and storage.
- **Man-hours**, all man-hours are accurately recorded against each work order, this is important especially when establishing jobs costs. This is particularly relevant to level one contracts where unplanned site attendance is chargeable.
- **Maintenance Schedules**, these take the form of a work order. For each installed device the OEM maintenance documentation is referred to in establishing the recommended workscope. The frequency of the planned maintenance is dictated by OEM recommendations and the operating environment experienced on each site.

- **Component changes**, this section enables the system operator to remove and install components from old location reference to new location reference. The system has the ability to carry with each device all its historic movements, dates installed/removed, hours run and associated costs.
- **Repairs**, components removed and sent back to suppliers under project references can be tracked with movement date references generated within the system which cannot be altered by the operator. This is useful when target dates promised by suppliers are passed without the repair being completed.
- **Hours Update Page**, here the system operator will input the new skid hours which can be the controlling 'clock' which all planned maintenance events are referenced against. The update can take place weekly, monthly or at any time. The vital key element here is that it updates all the individual component clocks detailed on the location listing.
- **Photo/document Library**, this permits a manufacturers specification sheet or digital visual reference to be associated with each device location reference. This helps in identifying the component, its orientation and specific installation requirements. It is always good to see the item and confirm with the suppliers that it matches an order given especially when there is an element of doubt about suitability. Time and money losses through incorrect supply are therefore reduced.



- **Work Order Archive**, all completed servicing documentation can be stored here, all filed against project reference numbers. It provides the ability to investigate historical problems and cross check engineers service reports.
- **Service Kits**, many scheduled tasks have predetermined component spares support kits, these can be listed here and cross checked against stock listings thereby identifying any shortages. The kits need not be stored as a single item, thus releasing items for other unplanned events. Other service kits may be smaller and intended for less extensive service work i.e. a ball valve service kit may consist of valve seats, gaskets, sprigs etc. They are listed here and linked to their respective component tag number, thus providing the operator with immediate support information on a tag number enquiry.
- **Running Hours**, an individual page showing main rotating component lives and estimated remaining hours to run. In addition the availability of the unit can be displayed here.

Summary

To summarise, the system operates around three key elements:

1. Location – a specific location reference for a single device i.e. drawing and ident reference number.
2. Type – a specification reference for a single device i.e. part number/model number.
3. Asset – a specific number identifying a single device i.e. serial number.

All the administration functions within the system operate around these 3 key elements. The system's main strength is its ease of use, capacity to monitor cost control and trace-ability of device history. The principal results are:

1. Higher plant availability
2. Lower maintenance cost
3. Better scheduling of down-time
4. Continuous improvement
5. Fully auditable maintenance
6. Better monitoring of unscheduled events

Should any further function of the system require further explanation then a demonstration can be arranged.

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