

CASTROL ULTIMAX - AIR COMPRESSORS

AIR COMPRESSORS



Castrol Aircol SN 68 and 100 are diester based synthetic lubricants with excellent oxidation resistance and low carbon-forming tendency.

Aircol SN 68/100

Synthetic Reciprocating
Air Compressor Lubricant



CASTROL ULTIMAX - AIR COMPRESSORS

ADVANTAGES: AIRCOL SN 68/100



Application

High temperature, high pressure Reciprocating Air Compressors

Advantages at a glance

- Greater reliability at high discharge temperatures up to 200°C
- Low carbon forming tendency
- Improved film strength and lubricity
- Excellent oxidation resistance

*Compared to conventional lubricants

CASTROL ULTIMAX - AIR COMPRESSORS

BENEFITS: AIRCOL SN 68/100



Customer benefits

- Greater compressor efficiency due to valve cleanliness
- Reduced compressor downtime due to less wear on cylinders and rings and all moving parts
- Reduced oil consumption
- Extended intervals between cylinder head overhauls, subject to operational conditions
- Helps to reduce cost of ownership due to reduced maintenance, extended oil service and equipment life



*Compared to conventional lubricants

CASTROL ULTIMAX - AIR COMPRESSORS

SPECIFICATION: AIRCOL SN 68/100



OEM approvals

- Recommended by various manufacturers including: TANABE, YANMAR, HATLAPA, SPERRE
- Aircol SN 68 is also recommended by ABB Turbo Systems Ltd as a 'List 3' Synthetic oil



ABB Turbo Systems

CASTROL ULTIMAX - AIR COMPRESSORS

CASE STUDY: AIRCOL SN 68/100



Application

Reciprocating compressor

Customer name / sector

Petrochemical plant

Situation

Because of leakage through the valves it was necessary to run at times three compressors to maintain the integrity of the ring line to 95psi

- Broomwade VMD 500
- 90kW input power
- Rota – Duty / Duty Assist / Standby
- Lubricated as per OEM ISO VG 68 Mineral oil

Castrol solution

- At shut down #1 and #3 compressors were fully overhauled by the OEM, but brand new valves were fitted to #2
- #1 and #3 was charged with Aircol SN 68

Results

- Valve examination interval increased from 4 to 20 months and have not required cleaning
- Top up rate has been reduced by 50%. Estimate 18% due to the superior oil and remainder due to less run time per unit
- Oil life up to 20,000hrs compared to previous result of less than 4,000hrs confirmed by UOA

(cont...)



Results (cont.)

- Delivered an energy saving of 53% – much due to the overhaul and the fact that there was minimal valve leakage.
- Only the duty ran with the duty assist running approx 3 x 1 hour periods per day.
- The units with the Aircol SN drew 5.3% less power than the one with the mineral charge. The mineral oil charged unit was switched to the synthetic Aircol SN 68.
- Further improvements to the ring line leakage – duty unit maintains its integrity.
- The units are now cycled every four months. After 7 years the original charge of Aircol SN 68 is still in very good condition.

Other realizations

- Valve cleaning almost eliminated
- Lubricant changes pushed out to 7yrs +
- Reduced environmental impact
 - Energy savings
 - Disposal cost saving

*Compared to conventional lubricants

CASTROL ULTIMAX - GEARBOXES

GEARBOXES



Optimising your reliability whilst
managing your assets preservation

Tribol[®] 1100/150-1500

Gear Oils with TGOA[®]





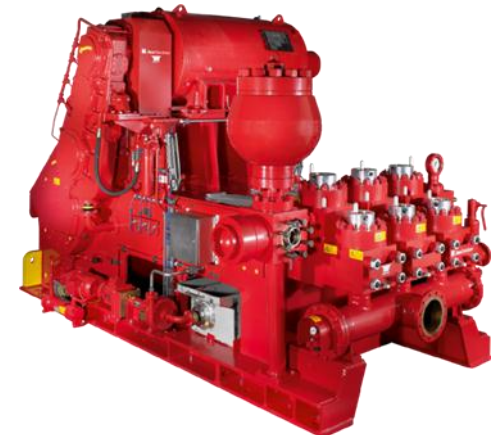
Application

Product: Castrol Tribol® 1100, 150, 220, 320, 1000, 1500

- Castrol Tribol® 1100 oils are particularly valuable in the running-in phase as well as in applications where surfaces have already been damaged in the micro-range
- Particularly suitable for heavy duty reciprocating pumps for drilling mud or cement placement offshore and onshore drilling sites
- Jacking gearboxes

Advantages at a glance

- A prevention or elimination of running-in pitting
- Extremely low coefficients of friction
- A temperature reduction at the lubricating points



*Compared to conventional lubricants

CASTROL ULTIMAX - GEARBOXES

BENEFITS: TRIBOL® 1100



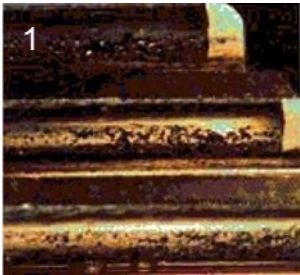
Customer benefits

- Extended service life of your equipment
- Reduced maintenance due to minimum wear
- A higher availability of machinery due to fewer failures, less downtime and repair work
- No additional running-in lubricants
- Helps provide a reduction of lubricant and disposal costs as well as significant temper of overhaul charges

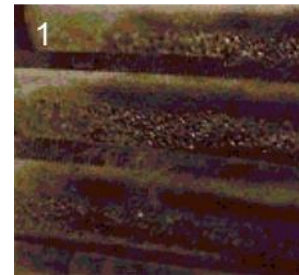
*Compared to conventional lubricants



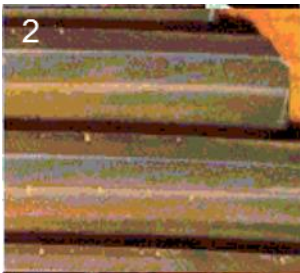
Gear wheels in drum drives



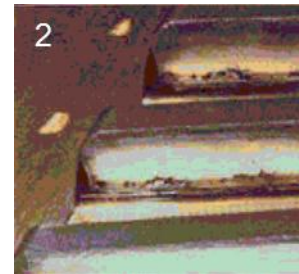
1 Standard spur gear lubricated with conventional EP lubricant.



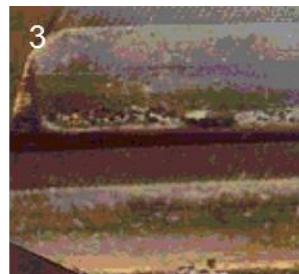
1 Three-stage spur gear unit. Progressive pitting formation with a CLPF 460 gear oil.



2 Same standard spur gear lubricated for 10,000 hours using Tribol® 1100 series of the same viscosity class. Smooth surface of the teeth gives more contact hence less stress, less temperature which increases lubricant life.



2 Smoothing effect after one year of using a high performance lubricant with PD characteristics.



3 This condition remained stable after 5 more years and the lubricant applied prevented the formation of new pittings.

CASTROL ULTIMAX - GEARBOXES

SPECIFICATION: TRIBOL® 1100



Industry specifications

Meets the specifications of:

- Elecon formerly David Brown
- DIN 51517 Part 3 CLP



Application

14-P-220 triplex mud pumps

Customer name / sector

Shipyard, Korea

Situation

- A drilling operator had evidence of teeth pitting using common mineral gear oil enhanced with some solid additive
- Very fast oil deterioration

Castrol solution

- Outstanding performance of Tribol® 1100-460 on load-carrying & teeth protection at high temperature
- Good additive package technology
- Additive pack in true solution

Results

- Micro pitting arrested!

*Compared to conventional lubricants

CASTROL ULTIMAX - GEARBOXES

GEARBOXES



Optimising your reliability whilst
managing your assets preservation

Alphasyn EP 150-680

Synthetic Gear Oils



CASTROL ULTIMAX - GEARBOXES

ADVANTAGES: ALPHASYN EP



Application

- Heavily loaded gearboxes subjected to extremes of temperature
- Draw works transmissions on Mobile Offshore Drilling Units and Onshore sites
- Top drives on Mobile Offshore Drilling Units and Onshore sites

Advantages at a glance

- A high Viscosity Index (VI) makes the product suitable for operations over a wide temperature range
- Good water separation and demulsification characteristics
- Good compatibility with seals, paints and mineral oil based lubricants
- Rapid air release prevents foaming and bearing damage



*Compared to conventional lubricants



Customer benefits

- Protects gears against wear and corrosion
- Prevents gear damage by maintaining film thickness
- Ensures longer equipment life and reduction of maintenance activities leading to decreased operational and life cycle costs
- Good thermal and oxidative stability helps provide extended drain periods, longer equipment life and energy savings when compared to mineral oil-based products



*Compared to conventional lubricants



OEM approvals

Alphasyn EP is classified as follows:

- DIN Classification is CLP

The Alphasyn EP range meets the requirements of:

- DIN 51517 Part 3
- AGMA 9005 - D94
- Elecon formerly David Brown
- Hansen Transmissions



CASTROL ULTIMAX - GEARBOXES

CASE STUDY: ALPHASYN EP



Application

Heavily loaded high temperature gearboxes

Customer name / sector

Utilities company

Situation

Concern expressed over oil life varying from 9-12 months based on in-house laboratory analysis, the criteria being acidity increase and iron particulate, however technicians were also concerned about burning oil smell

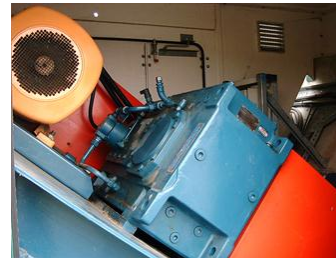
Details

- Slurry elevator
- Flender K401 712 310-3-2
- Two stage Spur / Helical Bevel configuration
- Input 1460 rpm output 33 rpm Ratio 45:1
- Motor power 55Kw
- Running temperature (mineral oil) = 76°C
- Lube volume = 35 litre
- Lubrication system = spray

Castrol solution

Mineral grade changed to Alphasyn EP 220

- Operating temperature reduced by 5.5°C
- Steady state power saving = 1.2%
- Additional start up* power saving = 2.3 %
- Burnt oil smell gone
- Oil life in excess of 3 years



*Compared to conventional lubricants



Results

The operating company declared and energy saving benefit of \$208 per year per gearbox.

However a full benefit analysis cannot be tabled as yet as the trial is incomplete because:-

- After two years a decision was taken to change a further 76 gearboxes over to Alphasyn EP
- After three years the latest test data shows the Alphasyn EP 220 still in specification and fit for further service

Cost saving \$16,000 per year

Including costs of synthetic product and other benefits e.g. extended fluid life etc.

*Compared to conventional lubricants



Theoretical cost benefit analysis for offshore application

Consider an electric motor driven top drive!

Traditional top drive gearboxes are robust and have relatively simple gear nomenclature consisting in the main of spur and helical gearing.

UP TO 4% of the of the input power can be lost due to transmission losses known as parasitic power drain.

UP TO 50% of these losses can be saved resulting in 2% saving in transmission or real energy power lost due to friction.

- Typical top drive = 1800hp or 1350 kw
- Average fuel consumption to produce 1000kw = 320 litres per hour
- Av. consumption for 1800hp top drive with conventional lubricant 432 litres per hour

Fuel savings by application of Alphasyn EP = 8.65 litres per hour with an average fuel cost of \$0.55per litre.

This CAN equate to a savings in fuel cost of over \$40,000 per annum.

However further tangible benefits are:

- Reduced noise
- Reduced operating temperature
- Reduced overhaul cost due to radically reduced wear
- Reduced maintenance attention
- Reduced health and safety impact
- Positive environmental impact

*Compared to conventional lubricants



Optimising your reliability whilst
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Alphasyn PG 150-460

Synthetic Gear Oils





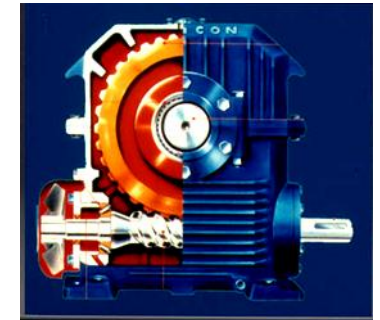
Application

Agitators, worm gearboxes

- The Alphasyn PG range is based on select polyalkylene glycol fluids that provide high thermal stability. They are intended for all types of heavily loaded gearboxes operating in the extremes of temperature but are particularly suitable for worm gearboxes.

Advantages at a glance

- High VI that makes the product suitable in all operational conditions
- Greater lubricity compared to conventional mineral oils
- Good thermal and oxidative stability
- High load carrying capacity



*Compared to conventional lubricants



Customer benefits

- The high VI ensures the product is suitable for use in different climates, so when your asset moves there is no need to change the product
- Reduced start-up loading
- Reduced operating temperatures ensure longer oil service life
- Designed to provide operational efficiency through extended drain periods and energy savings



*Compared to conventional lubricants

CASTROL ULTIMAX - GEARBOXES

SPECIFICATION: **ALPHASYN PG**



OEM approvals and industry specifications

Alphasyn PG meets the requirements of most OEMs that allow the use of PAG-based gear oils



Application

Agitators, worm gearboxes.

An industrial application almost identical to a mud pit agitator offshore.

Customer name / sector

Primary industry (paper)

Situation

At a mill, power consumption was an issue as the plant had been up rated to the limit of the equipment. The electrical team initiated the call asking if there was “fancy lubricant” that could reduce losses in the gearbox but particularly on cold start up as the specific plant didn’t always pull in due to over current trips.

Details

- Pulp chest agitator
- 20 tonne capacity
- Gearbox Croft foot mounted worm and pinion
- 40:1 reduction
- 16kw 1460 rpm motor
- Solid Oldham coupling (no fluid coupling)
- Lubricant 23l 320Cst R & O Oil

The original oil employed was a 320 EP gear oil mineral but because of overheating and yellow metal staining which was a result of the overheating, moisture ingress and a reaction with the sulphur phosphorous additive pack to cause acidic attack on the worm wheel the oil was changed to an R & O 320 grade.



Castrol solution

Given the criteria it was decided to change the oil for Alphasyn PG 220 because of its extremely high VI and its lubricity which is a perfect match for the sliding faces on worm wheel.

The average power consumption with the 320 R&O oil **18.2KW**.

The average power consumption with the Alphasyn PG 220 **12.6KW**.

This represents a net power saving of 30% **(\$688 per day)** and the start up trips were eliminated (\$251,000 per year).

Note

The 30% power saving is an excellent result and sings the virtues of a PAG in a worm box application as an energy saving lubricant but this is a false result because the initial readings were artificially high because of churning losses hence the heat due to too high a viscosity grade being employed.

A more realistic saving by employing a PAG in a worm box would be up to 20% and usually a plant may employ up to 40 gearboxes.

The price of trade up was never discussed as the plant stated that the uplift was insignificant compared to the savings in power but more to the point the assurance that it would start without trips.

*Compared to conventional lubricants

CASTROL ULTIMAX - TURBINES

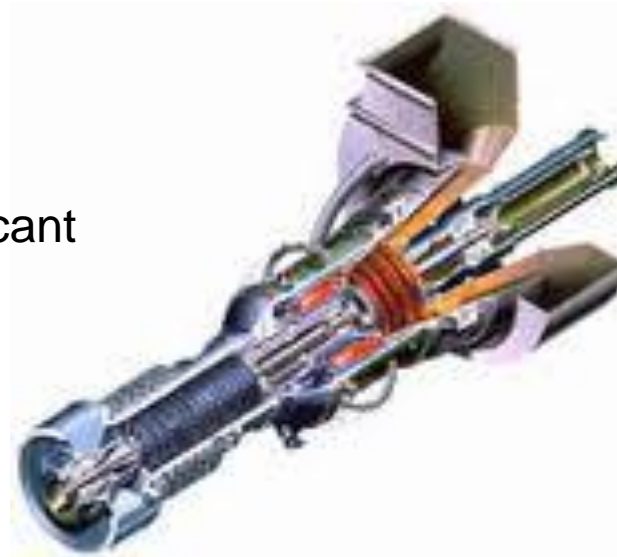
TURBINES



Optimising your reliability whilst
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Perfecto SN 46

Synthetic Gas Turbine Lubricant



CASTROL ULTIMAX - TURBINES

ADVANTAGES: PERFECTO SN 46



Application

- Perfecto SN 46 is a synthetic hydrocarbon based lubricant which has been developed for the lubrication of industrial gas turbines, gas compressors and other items of rotating equipment in the extremes of temperatures
- Designed for use as a gas turbine lubricant
- Major advantages over mineral oils
 - to protect equipment during extreme cold weather starting
 - extended high temperature operation
 - where the unit is subject to severe heat soaking after shutdown

Advantages at a glance

- Minimises sludge or deposit formation
- Excellent wear and rust protection
- Extends service life even in high temperature operations
- Helps to protect equipment during extreme cold weather start up
- Helps to protect equipment where the unit is subject to heat soak



Customer benefits

- Extended oil service life
- Increased cleanliness leading to improved efficiency and extended life cycle of the bearings
- Helps to reduce operational costs by maximising the availability of your equipment and reducing maintenance activities during shutdown periods



*Compared to conventional lubricants

CASTROL ULTIMAX - TURBINES

SPECIFICATION: PERFECTO SN 46



Meets requirements of

- DIN 51515 Part 2, Alstom HTDG90117, GE Gek 28143A, Gek 32568G, Siemens TLV9013 04 & 05, Solar ES 9-224 U, MAN-TURBO SP10000494596, BS 489:1989

ALSTOM



SIEMENS





Application

Sultzzer Centrifugal Export Compressor

Customer name / sector

North Sea Production Platform
Oil and Gas

Situation

Compressor suffered seal failure leading to unscheduled shut down and the operator sought assistance from the seal manufacturer and Castrol Offshore to provide an expedient solution

Castrol solution

The decision was made to change the lubricant to a synthetic alternative to give a higher degree of thermal stability.

Perfecto SN46 was installed in the compressor and a stricter oil analysis program employed to monitor this in service.

Results

Two years later on a planned examination the seals were found to be **free** of deposits.

Seven years on the Perfecto SN46 is in good condition according to Oil analysis and there have been no unplanned shutdowns.

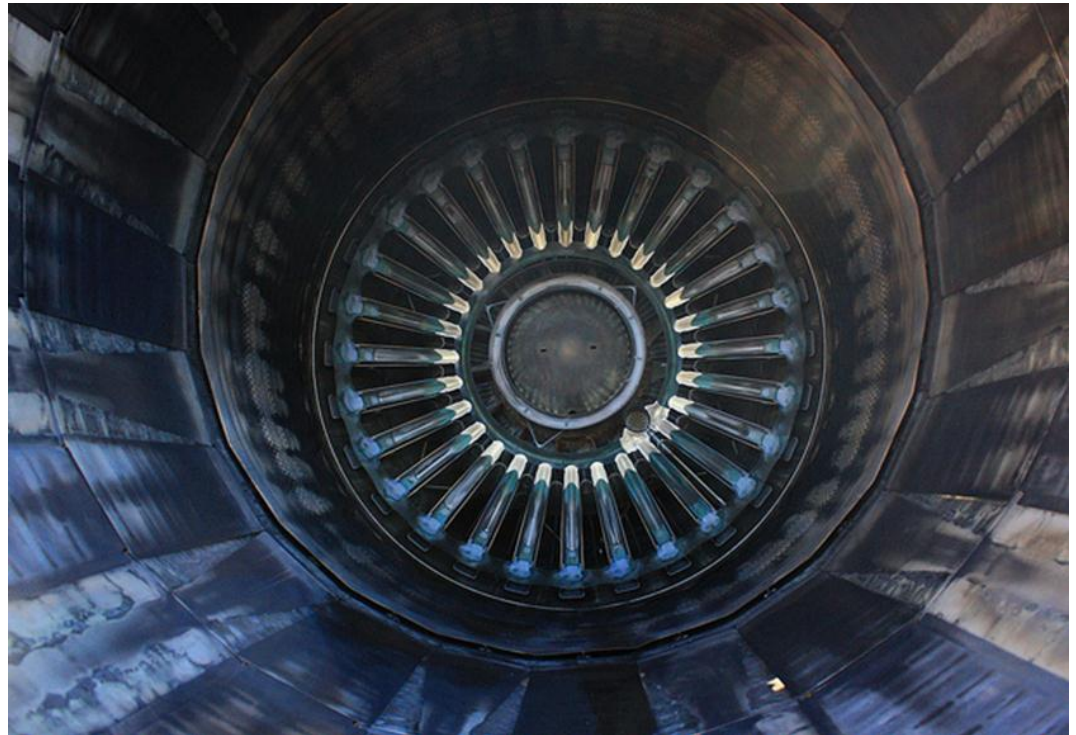
CASTROL ULTIMAX - TURBINES

TURBINES



Optimising your reliability whilst
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BP Turbo Oil 2197



CASTROL ULTIMAX - TURBINES

ADVANTAGES: BP TURBO OIL 2197



Application

BP Turbo Oil 2197 is a latest generation 5 cSt High Thermal Stability (HTS) synthetic lubricant, within the aviation industry. At zero altitude it is also proven, lubricating aero-derivative gas turbine packages driving alternators, gas compressors and export pumps.

Advantages at a glance

- Maintains very low levels of deposits under severe thermal stress leading to significant improvements in cleanliness
- Excellent thermal stability
- Excellent oxidation stability
- Unmatched hydrolytic stability and metal passivation

*Compared to conventional lubricants



Customer benefits

- Longer service intervals and reduced component wear
- Reduced incidence of oil filter replacement
- Considerably reduced maintenance costs
- Assured availability of equipment and reliability of operations
- Provides exceptional performance in the most demanding turbines and helps extend maintenance intervals leading to reduced overhaul costs

*Compared to conventional lubricants



Cyclic Coker Mister results – competitor HTS oils vs. BPTO 2197

- Predicts Competitor A's R-R Trent HP/IP vent tube coking
- Competitor B oil generally similar in performance to Competitor A oil
- BPTO 2197 exhibits lower demerit ratings and deposit weights
- Used BPTO 2197 contained 12x less particulate matter versus used Competitor B oil
- Both competitor oils plugged post test filtration medium

Competitor A

Competitor B

BPTO 2197



Deposit Rating	Vapour	5.0	Deposit Rating	Vapour	6.1	Deposit Rating	Vapour	3.4
	Liquid	4.8		Liquid	5.5		Liquid	3.3
	End plate	5.9		End plate	7.0		End plate	4.7
Deposit Weight (gm)	Vapour	0.84	Deposit Weight (gm)	Vapour	0.40	Deposit Weight (gm)	Vapour	0.16
	Liquid	0.52		Liquid	0.46		Liquid	0.29
	End plate	0.32		End plate	0.35		End plate	0.19
Filter		0.466 g/L	Filter		0.151 g/L	Filter		0.0124 g/L
		Plugged at 50ml			Plugged at 120ml			No Plugging

CASTROL ULTIMAX - TURBINES

SPECIFICATION: **BP TURBO OIL 2197**



OEM approvals

- Meets MIL-PRF-23699F HTS including elastomer compatibility
- BPTO 2197 is by far the most widely used HTS fleet oil in the world. It is approved by all leading OEMs. Full list of approvals is available on request



Application

KB Series aero derivative gas turbines

Customer name / sector

Power plant

Situation

Annual maintenance was an issue with these units because of carbon deposition and overhaul turnarounds due to time taken to physically remove carbon deposits

Castrol solution

BP 2197 enabled a radical improvement to engine and accessory reliability plus a significant reduction of operating and maintenance costs.

Results

- Near elimination of carbon build-up
- No unplanned oil filter changes
- Cleaner scavenge and oil supply tubes
- Spotless bearing compartments
- Cleaner gearboxes
- No carbon seal failure
- Lower oil consumption
- Cleaner oil reservoirs

*Compared to conventional lubricants

CASTROL ULTIMAX - TURBINES

CASE STUDY: BP TURBO OIL 2197 (cont.)



Fig. 1 shows carbon deposits on BC sump bearing after 8,000hrs operation using standard turbo oil.

Fig. 2 shows clean B/C Sump bearing after 14,000hrs utilising BP 2197 high thermal stability turbo oil.

Fig. 3 shows CRF scavenge tube adaptor from same engine after 8,000hrs using standard turbo oil.

Fig. 4 shows scavenge tube adaptor from same engine after 14,000hrs utilising BP 2197 high thermal stability turbo oil.



Fig. 1



Fig. 2



Fig. 3



Fig. 4



Cost benefit analysis result

The extension in time period between overhauls from nominally 8,000hrs to 13,000hrs.

With a drastic reduction in overhaul cost and duration resulted in a net saving of 14% in the power island cost center.

However this study was produced with the aforementioned step out in overhaul incidence but now sufficient confidence and indeed assurance has been gained and the overhaul period is stepped out to 26,000hrs.

A 28% cost saving per annum equates to \$180,800 at this site.