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ENGINEERING SUPPORT PROGRAM

Contract No. EDH-I-00-08-00027-00

Task Order No. 1

WO-LT-0083 AMD2 Task 2 Kandahar Area Diesel
Optimization Generator Analysis Report Revision 1



June 16, 2015

This publication was produced for review by the United States Agency for International Development. It was prepared by Tetra Tech, Inc.

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June 16, 2015

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Re: Contract No. EDH-I-00-08-00027-00/ Task Order No. 1
Afghanistan Engineering Support Program (AESP)

Kandahar Area Diesel Optimization Generator Analysis Report Revision 1

Dear [REDACTED]

Please find enclosed the study for WO-LT-0083 Amendment 2. This report combines and completes task 2 of the scope of work for this amendment. Thus, the report provides a study with recommendations for the economical and sustainable operation of the diesel generators in the Kandahar Area along with the corresponding pricing sheets.

Study recommendations include:

- Installation of Energy Recovery System enhancements on 12 Kandahar-area diesel generators; four at Bagh-e-Pol, four at Breshna Kot, and four at Shorindam Industrial Park (SIP).
- Transferring the loads currently serviced by the Little SIP (LSIP) power plant, to the SIP plant, and retiring the LSIP plant from service.
- Rebuilding multiple generators to maintain system operation for a projected period of four years.

Revision zero of this document was submitted on February 9, 2015 changes made to this Revision one report are listed on the record of revised documentation page found on page ii.

Please do not hesitate to contact me if you should have any questions regarding this report.

Respectfully,
Tetra Tech, Inc.

[REDACTED]

AFGHANISTAN ENGINEERING SUPPORT PROGRAM

Contract No. EDH-I-00-08-00027-00
Task Order No. 1
WO-LT-0083 AMD 2 TASK 2

Kandahar Area Diesel Optimization
Generator Analysis Report
Revision 1

June 16, 2015

DISCLAIMER

The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

RECORD OF REVISED DOCUMENTATION

- 1.) The cover has been changed to read Task 2. Previously it read Tasks 2 and 3.
- 2.) The cover letter has been changed to read Task 2. Previously it read Tasks 2 and 3.
- 3.) The cover letter has been revised to address to the new COR and ACOR [REDACTED] and [REDACTED]. At the time of Rev 0 publication [REDACTED] were COR and ACOR, respectively.
- 4.) The cover letter has been signed by [REDACTED] AESP COP. Previously, [REDACTED] signed as the ACOP for [REDACTED].

EXECUTIVE SUMMARY

Approach

The purpose of this report is to analyze the existing generators in the Kandahar Area and provide recommendations of how to best maintain economical and adequate electrical production until the NEPS/SEPS have been completed. Aftermarket turbogenerators can supplement Diesel Generator (DG) electrical power, effectively improving overall thermal energy conversion and conserving fuel. These units are placed in the exhaust path immediately downstream from the main engine turbochargers and drive a high speed permanent magnet generator (PMG). Power produced by the PMG is electronically conditioned and applied to the 50Hz power grid. This electrical energy supplements the normal DG electrical power and improves the electrical production, decreasing fuel consumption by 6-8%. The turbo-generator/PMG combination is commonly known as an Energy Recovery System (ERS).

The NEPS/SEPS Connector (a 220kV transmission line) is scheduled to be completed to the city of Kandahar in approximately four years. At that time, it is expected that all Kandahar area Diesel Power Plants (DPP) will be retired from service. Until that time, DABS will experience an excessively high cost of production of electric power due to the high costs of diesel power generation. Use of ERS technology will help to offset these high costs.

Early in the investigation it became apparent that due to the age of the equipment, multiple DG overhauls (rebuids) will be required to maintain adequate electric generation capabilities over the next four years. This report provides an overall plan of action to provide electric power at the lowest possible generation cost.

Thirty-three existing DGs, and three spare DGs (reportedly warehoused at the Bagh-e-Pol site), were evaluated for possible modification with the above ERS devices. The assessment process evaluated the DGs using the following criteria:

- Provide the maximum reduction in electric production costs with the minimum of plant investment.
- Provide a Plan of Action which will maintain the necessary additional operating life of the DPPs until the changeover to the transmission connector occurs.
- All enhancement and overhaul costs must be recoverable within a four-year period to be considered as viable.

Findings

Evaluation of the 36 DGs revealed the following existing conditions:

- At Bagh-e-Pol DPP: 4 of 8 DGs were not operational, and 3 of the 4 operational DGs were over 90% of their expected rebuild period. There are also 3 rebuilt non-connected spare DGs available.
- At Breshna Kot DPP: 1 of the 7 DGs was not operational. All DGs had low operational hours.
- At Shorindam Industrial Park (SIP) DPP: 5 of 8 DGs were not operational, and all operational units had exceeded their rebuild intervals.
- At Little SIP (LSIP) DPP: 8 of 10 DGs were not operational, and both operational units had exceeded their rebuild intervals. The DGs at this site were much smaller units, which require much more frequent rebuilds (approximately 3 times as often) compared to the larger units located at the above DPPs.

Part of the evaluation period involved development of load projections for each site. DABS provided the generation data shown in Table 1 of Appendix A. Combining this data with the Recent Survey Summary found in Table 4 provides the foundation for this report.

This evaluation was limited to providing the minimum major maintenance and ERSEnhancements to maintain plant operation. No maintenance or improvements were expected for redundant or spare DGs at the sites.

Conclusion

The following plan of action is recommended to provide efficient DG power to the Kandahar area over the next four years:

- Immediately relocate and install one of the three spare DGs from Bagh-e-Pol to SIP. Transfer all LSIP loads to SIP and retire LSIP from active service.
- No LSIP DGs are recommended for rebuild or enhancement.
- Bagh-e-Pol is expected to carry loads requiring 4,289kW to 5,120kW, which requires four DGs. To achieve this, the following should be performed:
 - Replace BP4 and BP5 with the two existing rebuilt spares
 - Rebuild BP2 and BP7
 - Enhance BP2, BP4, BP5, and BP7
 - All DGs will also require one additional rebuild within the next four years
- Breshna Kot is expected to carry loads requiring 2,163kW to 4,825kW, which requires two to four DGs. To achieve this, the following should be performed:
 - Enhance BK1, BK3, BK6, and BK7
 - Because present hours are low, continue operation of the above to about 18,900 hours at which time, they should be rebuilt
 - All DGs will require one rebuild within the next four years
- SIP (after the addition of LSIP loads) is expected to carry loads requiring 4,417kW to 5,040kW, which requires four DGs. To achieve this, the following should be performed:
 - Install the spare DG from Bagh-e-Pol as S
 - Rebuild S3, S4, and S5
 - Enhance S1, S3, S4, and S5
 - All DGs will also require one additional rebuild within the next four years

This rebuild and enhancement program is expected to cost \$6,160,040. Table 3 of Appendix A details additional evaluation data. Cost is expected to be recaptured by decreased operating fuel costs within an average of 2.9 years of operation. In the event that each DG modified is operated for four years, the modifications will save \$9,087,847 in fuel oil resulting in a return of more than \$2,927,807 over initial investment.

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1.0 INTRODUCTION

1.1 BACKGROUND

Kandahar City receives power from multiple unsynchronized sources including Kajaki Hydro Power Plant (HPP) and several diesel generators. As part of an economic growth initiative, the United States Department of Defense (DoD) has been providing fuel subsidies to Da Afghanistan Breshna Sherkat (DABS) for two diesel power plants (DPPs) located at Bagh-e-Pol and Shorindam Industrial Park (SIP & Little SIP). The fuel subsidies were scheduled to be sharply reduced in December of 2014. Since that time, DABS has been responsible for providing most of the fuel to operate the diesel plants in Kandahar City.

As a result of dramatically increased fuel oil operating costs, DABS has reduced the time that most of the Kandahar-area generation plants operate, to between 0 and 19.7 hours per day. Only the LSIP power plant continues to operate 24 hours per day. This reduction in available electricity negatively impacts business and the public, and will not be acceptable during the ensuing 4-year period while the SEPS Connector is completed. The current plan is to return each DPP to operating 24 hours per day after Energy Recovery Systems (ERS) have been installed.

This project builds on and expands the Diesel Optimization discussion found in WO-LT-0083, *Kandahar Solar Photovoltaic Feasibility Study*. The primary objective of this project is to identify the benefits, costs, and timelines required to engineer, procure, and install ERS systems on selected Kandahar area DPPs and maintain DG operation until the transmission connector arrives.

Diesel optimization serves to either increase the output of the system or to reduce fuel usage. The goal of this enhancement will be to reduce diesel fuel use while maintaining the current load. Increasing available capacity is not the current objective for optimizing Kandahar area DPP sites.

1.2 METHODOLOGY

Many methods of waste heat energy recovery from diesel generators exist. Examples include heat exchanges from engine cooling fluid and/or exhaust systems. The cooling fluid approach produces large amounts of low-temperature energy. This type of energy is difficult to convert into electrical power as the temperature is not adequate to produce steam. Heat exchangers installed in the exhaust system collect waste heat by cooling the waste exhaust gases. Typically, this approach results in excessive maintenance requirements, as the diesel exhaust contains large amounts of unburned materials which condense on the cool heat exchanger and decrease operating efficiency.

Due to the deficiencies inherent in the above systems, the earlier report suggested using an approach which incorporates an additional turbine in the exhaust flow and directly drives a small generator. Such a system is shown in Figure 1, below. Additional photographs of ERS are shown in Appendix B.

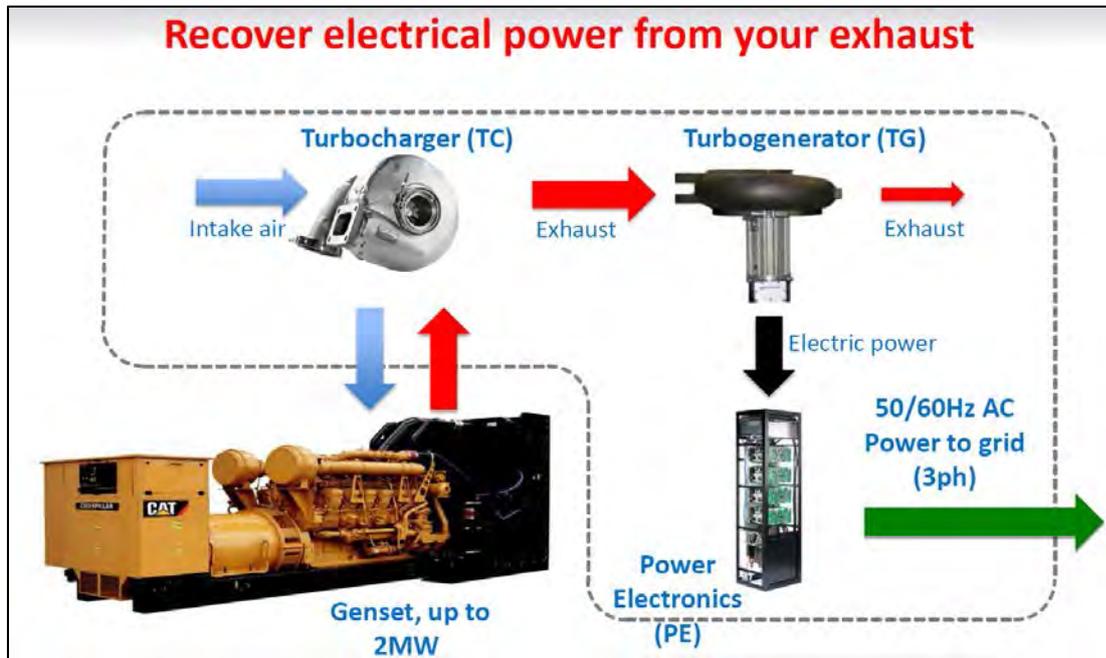


FIGURE 1

Accurate generator data is required to properly evaluate diesel generator retrofit options. Because this data was not readily available during the WO-LT-0083 process, the diesel optimization analysis began with field data collected from each DPP site.

During late 2014, survey teams were sent to the four generation plant sites to collect the information necessary to determine the suitability of generator enhancement using the ERS. The survey concentrated on collecting the following information on each individual diesel generator set:

- Location
- Generator ID Number
- General Condition
- Age
- Hours
- Fuel Consumption
- Engine Description
- Model Number
- Serial Number
- Power Rating
- Operation Conditions

2.0 EXISTING SYSTEMS SURVEY

On November 16, 2014, a Tetra Tech team went to Kandahar to gather data on the existing Bagh-e-Pol, Breshna Kot, and Shorindam Industrial Park diesel generator facilities. Field inspection reports, photographic records, and existing drawings can be found in Appendix C. The Table 4 matrix found in Appendix A provides a brief summary of the collected data.

Bagh-e-Pol Site

The Bagh-e-Pol site is located 20 km west of Kandahar City. Field survey data for this site is shown in Appendix C.1. The generators are installed on a site previously used for grain storage.

There are currently eight generators that are connected, and three more that are not installed. Of the eight connected generators, four were found to be operational and in “good” to “fair” condition. The remaining four were non-operational. All have excessive hours. During normal operation this site runs 19.7 hours a day at approximately 1120 kW/DG loading.

Breshna Kot

Breshna Kot is located in the city center and is the current city substation. Field survey data for this site is shown in Appendix C.2. There are three diesel power plants; two older and one newer. The two older DPPs are not operational, and will not be considered for rebuild or enhancement. The newer DPP has seven generators currently installed, one of which is not currently functional. This site is mainly used when power from Kajaki Hydro Power Plant (HPP) is insufficient. During normal operation this site runs 19.7 hours a day at approximately 1220 kW/DG loading.

The Shorindam Industrial Park (SIP) facility has eight installed generators. Field survey data for this site is shown in Appendix C.3. Only three of these generators are identified as being in “good” condition while the remaining five are not operational. During normal operation this site runs 19.7 hours a day at approximately 1,120 kW/DG loading.

The Little SIP (LSIP) facility has 10 generators on site. Field survey data for this site is shown in Appendix C.4. Only two are identified as being in “fair” condition and have excessive hours. The remaining eight are not operational. These DGs are of a smaller type, and typically require rebuilding much more often than the larger generators. The data in Appendix A, Table 4 shows that the expected life between rebuilds of these smaller DGS is only 5,457 hours, as compared to the larger units lasting an average of 18,944 operating hours. This difference in life expectancy is significant to our conclusions.

3.0 RETROFIT EVALUATIONS

Appendix A contains the tables referenced in this section. These tables provide an automated method of quick evaluation of which existing generators are worthy of enhancement with the ERS technology. The approach for evaluation is to establish a set of performance or life time projects which will be compared and contrasted to the benefit of costly engine enhancement with the ERS.

3.1 EVALUATION FACTORS

Thirty-three existing Diesel Generators (DG), and three spare units (reported at Bagh-e-Pol), were evaluated for possible modification with the above Energy Recovery System (ERS) devices. The evaluation process is intended to:

- Determine the maximum reduction in electric generation costs with minimum plant investment, and provide a plan of action to maintain the necessary DPP additional operating life (through engine overhauls) until the transmission connector arrives.

In order to be recommended for modification all enhancements and rebuild costs must be recovered within the four year period.

3.2 ESTABLISHMENT OF DPP LOAD

The Report Input Data sheet (of Appendix A) shows the input parameters of the evaluation process. This program is Excel-spreadsheet-based and offers a quick and efficient method of evaluation simply by varying the input parameters. The source data is also detailed on the Report Input Data sheet. Other supporting parameters are documented in the various records of Appendix D.

This sheet also accounts for a timeframe of contract administrative period prior to enhancement modifications. During this period the DGs continue to age (accumulate operating hours), which affects the above evaluation factors. This period is currently estimated at six months. The spreadsheet however indicates that even a doubling of this period would not affect our recommendation.

The ERS system is expected to recover 11-13% of the waste heat and convert it to electrical power. For a conservative evaluation we based the choice on 11.1%. At this level the decrease in fuel costs is typically 6-8%. As the diesel power represents the major cost of electricity production, the ERS savings are nearly directly reflected in the cost of power production.

Table 4 represents the base data provided via the field survey information. It is based on the field survey information shown in Appendix C.

The evaluation of which DGs should be rebuilt/enhanced is dependent on the projected DPP electrical demand. As discussed earlier, Table 1 provides the baseline generation for the Kandahar area. Breaking this down into individual sites is more difficult. Baseline data is:

- The kWh annual generated loads are as shown in Table 1.
- Generator sizes and number are at each of the four DPP sites, from Table 4.
- Breshna Kot DPP is mainly used to make up loads which cannot be supported by Kajaki HPP due to insufficient water levels.
- Present (curtailed) loads at the four sites are reported at:
 - Bagh-e-Pol (BP) = $4 \times 1,120\text{kW} = 4,480\text{kW}$
 - Breshna Kot (BK) = $6 \times 1,220\text{kW} = 7,320\text{kW}$ (not all DGs operate simultaneously)
 - SIP = $3 \times 1,120\text{kW} = 3,360\text{kW}$
 - LSIP = $2 \times 600\text{kW} = 1,200\text{kW}$

Analysis includes the following assumptions:

- All DPPs will operate 24 hours per day after enhancement
- DGs will not normally be loaded over 80% (this also allows for load peaking)
- BK has a small base load, even when Kajaki is producing its highest annual power
- BP and SIP produce power proportional to their number of DGs (at a common size)
- All data listed in the Report Input Data sheet of Appendix A is acceptable

Please refer to Table 5 of Appendix A. We start the analysis with the kWh data for Kajaki HPP for each cycle (60 days = 1 cycle). We see that Cycle #2 has the highest kWh produced over the year. We set this as the maximum HPP generation with available water sources. Therefore, Column 3 shows the BK power needed per cycle to make up Kajaki shortfalls. This data is converted to a cycle hourly kW demand by dividing by 1,440 (60 days x 24 hours).

On Table 6, we enter the total cycle DPP generation for the region (from Table 1). We then subtract the BK proportion of Kajaki makeup, and the 1200 kW continuous power generated at LSIP. The remaining power required must come from BP+SIP. These output of these sites is limited to 12,902,400 kWh ($1,280\text{ kW} \times 7\text{ DGs} \times 24\text{ h/Day} \times 60\text{ Days} = 12,902,400\text{ kWh}$). We see that demand during some cycles is above this capacity. This excess must be generated by BK, and is added to the BK total in Table 5.

In Table 6, subtracting the BK grid transferred power from the total BK+SIP power leaves us with the BP+SIP kWh power needed. Applying proportional power to these cycle demands then produces the per-site demand factors. Dividing these site figures by 1,280kW/DG maximum, we calculate the minimum number of DGs needed per site to meet cycle demands.

The above process is repeated for each cycle, and for each DPP, we find the minimum number of DGs needed. From other evaluations we found that rebuilds and enhancement of the LSIP DGs was not economical. To accommodate the load handled by the LSIP plant, we recommend transfer of its load to the SIP DPP.

Table 7 shows the effect of transferring the LSIP load to the SIP. The SIP calculated demand from Table 6 is added to the 1,200kW transferred. The result is divided by 1,280kW/DG to find the new number of required DGs at SIP.

To summarize the above calculations we find:

- No LSIP DGs are recommended for rebuild or enhancement
- Bagh-e-Pol is expected to carry loads requiring 4,289kW to 5,120kW; this requires 4 DGs
- Breshna Kot expected to carry loads requiring 2,163kW to 4,825kW; this requires 2-4 DGs
- SIP (after the addition of LSIP loads) is expected to carry loads requiring 4,417kW to 5,040kW; this requires 4DGs

After estimating regional DPP demands, we can further evaluate the best alternatives of rebuild and enhancement on a per-site basis.

3.3 DPP SITE EVALUATIONS

The following sections discuss the evaluations & recommendations for each DPP site in the Kandahar area. As discussed earlier, the goal is to establish a plan to maintain power production over the next four years until the NEPS/SEPS connection is established. The plan must be maintainable and sustainable.

In order to fully evaluate the cost savings offered by any ERS, we must establish the fuel use before and after enhancement. The difference represents the savings. Because the DGs of the three larger sites are all within 5% kW rating, we will assume all have similar fuel use per kW produced. Fuel use for the smaller LSIP DGs is represented with a different curve.

From Table 4, we see that the Bag-e-Pol DGs (large DGs) use 288 L/Hr at 1120kW. This represents a single data point. To establish typical consumption over time we apply the typical use factors from the Diesel Service & Supply table in Appendix D for DGs similar to our 1,600kW rating. Table 8 of Appendix A provides the base data for fuel consumption of a large DG. Here, data at four operating loads is prorated for our 1,600kW DGs. Table 9 lists the results in L/Hr.

The four operating points are plotted in Figure 2, and a second-order quadratic equation is established to describe fuel consumption. Note that the function is accurate (R² factor) to 99.98% of the four data points used. In Table 10, this equation result at 1,120kW is compared to our known consumption of 288 L/Hr. The graph equation meets field data to much less than a 1% error, thus, the equation is established as accurate for our site data. The fuel consumption of the larger DGs is modeled as:

$$\text{L/Hr} = 0.00004 * \text{kW}^2 + 0.1551 * \text{kW} + 63.777$$

From Table 4, we see that LSIP DGs (small DGs) use 185 L/Hr at 600kW. We use the same procedure as above to establish their fuel consumption curve. We apply the typical use factors from the Diesel Service & Supply table in Appendix D for DGs similar to our 648kW rating. Table 11 of Appendix A provides the base data for fuel consumption of a small DG. Here, data at four operating loads is prorated to our 648kW DGs. Table 12 lists the results in L/Hr at four loads.

The four operating points are plotted in Figure 3 (Series 1, blue line), and a second-order quadratic equation is established to describe fuel consumption. Note that the function is accurate (R² factor) to 99.99% of the four data points used for typical DG consumption.

In Table 13, application of this equation result at 600kW is compared to our known consumption of 185 L/Hr. The graph equation requires a 15.51% adjustment to be accurate with the LSIP DGs. Figure 3 (Series 2, red line) shows the adjusted fuel consumption of the small DGs. The fuel consumption of the smaller DGs is modeled as:

$$\text{L/Hr} = 0.0001 * \text{kW}^2 + 0.1804 * \text{kW} + 39.44$$

3.3.1 Little SIP DPP Evaluation

The following discussion starts with the premise that LSIP would continue in operation.

Table 14 of Appendix A calculates the impact of rebuilding and enhancing two DGs with the ERS. The 3rd column lists the required site power from each DG operating (pre-enhancement). From that we calculate the predicted power generation from the Bowman ERS. Subtracting this ERS power from the total results in a post-enhancement power value per DG.

To find savings we apply the pre-enhancement and post enhancement fuel consumption equation for small DGs. Then, subtracting the post-enhancement fuel consumption from the pre-enhancement fuel consumption, we arrive at the fuel savings in L/Hr/DG. Based on the above calculations we estimate that the application of the ERS to these DGs can save 17.7 L/Hr/DG. The savings per DPP is computed by multiplying this savings by the number of DGs operating during that cycle.

The small DGs have a short (5,457 hour) operating period between rebuilds. This means they would each require seven rebuilds to last four years. This is not practical. Therefore, other DGs could be rebuilt in place of the first chosen two. Two additional ERS are included for these units.

Multiplying the DPP fuel savings by the cost per liter gives the savings (per PP) in \$/Hr. This is repeated for each cycle of the year. We then summarize the savings in various parameters at the bottom of Table 14. The ERS enhancement could save \$356,942/year. The enhancements cost is \$466,800, so the ERS enhancement could pay for itself in 1.31 years. This meets our requirements.

Table 15 shows the LSIP Project Costs. The excessive rebuilds cost \$945,000, making the rebuild/enhancement total project cost \$1,411,800. The project Payback period then becomes 4.46 years from now, over the required period.

Table 16 details that the ERS could save \$1,251,744 if used from the enhancement to the 4 year limit. However, due to the high project cost this represents a loss of 11.3% for this project.

Due to not meeting the project payback requirement, and the above investment loss, no rebuilds or enhancements are recommended at Little SIP. It is recommended to transfer LSIP loads to SIP, and retire LSIP.

3.3.2 Bagh-e-Pol DPP Evaluation

In Table 6 we established that 4 DGs would be necessary for Bagh-e-Pol DPP operation. This data is transferred to Table 17 of Appendix A, which calculates the impact of rebuilding and enhancing four DGs with the ERS per cycle. The 3rd column lists the required site power from each DG operating (pre-enhancement). From that, we calculate the predicted power generation from the Bowman ERS. This power equation is based on the 11.1% Enhancement Energy Production from the Input Data sheet, limiting the ERS power to 120kW per DG. Subtracting this ERS power from the total results in a post-enhancement power per DG. To find savings, we apply the pre-enhancement and post-enhancement fuel consumption equation for large DGs. Subtracting these consumption rates presents the fuel savings in L/Hr/DG. Here, we estimate that application of the ERS to these DGs can save up to 24.3 L/Hr/DG during a given cycle. The savings per DPP is computed by multiplying this savings by the number of DGs operating that cycle.

Multiplying the DPP fuel savings by the cost per liter gives the PP savings in \$/Hr. This is repeated for each cycle of the year. We summarize the savings in various parameters at the bottom of Table 17. The ERS enhancement could save \$958,419/year. The enhancements cost is \$1,106,680, so the ERS enhancement could pay for itself in 1.15 years. This meets our requirements.

Table 18 shows the BP Project Costs. Four years of rebuilds cost \$960,000, making the rebuild/enhancement total project cost \$2,146,680. The project Payback period then becomes 2.74 years; well within the required period.

Table 19 details that the ERS could save \$3,361,031 if used from the enhancement to the 4 year limit. This represents a positive return of 56.6% for this project.

This DPP meets or exceeds all factors for the rebuild/enhancement program. It is recommended that 4 DGs be included at BP.

3.3.3 Breshna Kot DPP Evaluation

In Table 6 we established that 4 DGs would be necessary for Breshna Kot DPP operation. This data is transferred to Table 20 of Appendix A, which calculates the impact of rebuilding and enhancing three DGs with the ERS per cycle. The 3rd column lists the required site power from each DG operating (pre-enhancement). From that we calculate the predicted power generation from the Bowman ERS. This power equation is based on the 11.1% Enhancement Energy Production from the Input Data sheet, limiting the ERS power to 120kW per DG. Subtracting this ERS power from the total results in a post-enhancement power per DG. To find savings we apply the pre-enhancement and post enhancement fuel consumption equation for large DGs. Then, subtracting these consumption rates presents the fuel savings in L/Hr/DG. Here we estimate that application of the ERS to these DGs can save up to 23.9 L/Hr/DG during a given cycle. The savings per DPP is computed by multiplying this savings by the number of DGs operating that cycle.

Multiplying the DPP fuel savings by the cost per liter gives the PP savings in \$/Hr. This is repeated for each cycle of the year. We summarize the savings in various parameters at the bottom of Table 20. The ERS enhancement could save \$670,070/year. The enhancements cost is \$1,106,680, so the ERS enhancement could pay for itself in 1.65 years. This meets our requirements.

Table 21 shows the BK Project Costs. Four years of rebuilds cost \$640,000 (as the BK DGs presently have low hours they will not need rebuilding for approximately two years), making the rebuild/enhancement total project cost \$1,746,680. The project payback period then becomes 3.11 years from now, within the required period.

Table 22 details that the ERS could save \$2,349,833 if used from the enhancement to the 4 year limit. This represents a positive return of 34.5% for this project.

This DPP meets or exceeds all factors for the rebuild/enhancement program. It is recommended that 4 DGs be included at BK.

3.3.4 SIP DPP Evaluation

In Table 6 we established that 4 DGs would be necessary for SIP DPP operation if it picks up LSIP load too. This data is transferred to Table 23 of Appendix A, which calculates the impact of rebuilding and enhancing four DGs with the ERS per cycle. The 3rd column lists the required Site power from each DG operating (pre-enhancement). From that we calculate the predicted power generated from the Bowman ERS. This power equation is based on the 11.1% Enhancement Energy Production from the Input Data sheet, limiting the ERS power to 120kW per DG. Subtracting this ERS power from the total results in a post-enhancement power per DG. To find savings we apply the pre-enhancement and post enhancement fuel consumption equation for large DGs. Then, subtracting these consumption rates presents the fuel savings in L/Hr/DG. Here, we estimate that application of the ERS to these DGs can save up to 24.2 L/Hr/DG during a given cycle. The savings per DPP is computed by multiplying this savings by the number of DGs operating during that cycle.

Multiplying the DPP fuel savings by the cost per liter gives the savings (per PP) in \$/Hr. This is repeated for each cycle of the year. Then we summarize the savings in various parameters at the bottom of Table 23. The ERS enhancement could save \$962,968/year. The enhancements cost is \$1,106,680, so the ERS enhancement could pay for itself in 1.15 years. This meets our requirements.

Table 24 shows the SIP Project Costs. Four years of rebuilds cost \$1,120,000, making the rebuild/enhancement total project cost \$2,266,680. The project Payback period then becomes 2.85 years from now, within the required period.

Table 25 details that the ERS could save \$3,376,983 if used from the enhancement to the 4 year limit. This represents a positive return of 49.0% for this project.

This DPP meets or exceeds all factors for the rebuild/enhancement program. It is recommended that 4 DGs be included at BK.

3.4 EFFECT OF FUEL COST

The proposed plan is based on current fuel costs of \$1.21/liter. Recently, fuel costs have decreased. However, future costs represent a major evaluation factor of this report. As costs increase the payback period decreases, making the proposed program even more attractive. However, if fuel costs substantially decrease the payback periods could exceed the 4 year payback parameter.

A tool for quick evaluation of fuel cost impacts is provided in Table 26 and Figure 4 of Appendix A. The payback period (time after enhancements) is shown for fuel rates from \$0.70/L to \$1.60/L.

3.5 PROJECT COST ESTIMATES

Table 3 of Appendix A lists the projected project costs. The ERS supplier-recommended budget cost is approximately \$276,670/engine in Afghanistan. Typically, the initial engine will require additional time for proper installation, but the remaining installations will go faster due to the repetitious nature of the enhancements. The entire enhancement per engine can be performed in an average of 7-10 days, so the DG downtime is minimal. This cost figure includes the pre-test cost on a per-DG enhancement factor, and is included in the enhancement /DG cost.

We recommend that one of the spare DGs at Bagh-e-Pol be moved and installed at SIP. The other two should be used to replace failed units at BP. This work would probably be performed by a different crew, perhaps even a subcontractor. We would expect this work would be performed simultaneously with enhancement efforts at Breshna Kot. Thus, the new DGs at Bagh-e-Pol would be ready for enhancements at the completion of the Breshna Kot site.

Table 3 of Appendix A details per-site and total project costs and their returns. As proposed, the full program rebuild/enhancement cost is \$6,160,040. This includes purchase, installation, 1st pre-testing, and training costs of the ERS as well as projected DG rebuilds over the next 4 years. The project is expected to return \$9,087,847 in savings by the arrival of the SEPS/NEPS connector. This represents a gain of \$2,927,807 over initial investment.

4.0 RECOMMENDATIONS

This investigation recommends that the following rebuild/enhancements program be applied to the Kandahar area DPPs in order to provide sustainable power to the region until the NEPS/SEPS connector is completed.

Bagh-e-Pol DPP

- 4 DGs are needed
- Relocate one of three existing rebuilds to SIP; use to power LSIP during Admin Period
- Continue operating on DGs BP1, BP3, BP6, and BP8 while installing the existing two rebuilt DGs into place of two failed units BP4, BP5
- Rebuild BP2 and BP7. Enhance DGS BP2, BP4, BP5, and BP7
- Rebuild BP2, BP4, BP5, and BP7 a second time over the four years

Breshna Kot DPP

- 4 DGs are needed
- Continue operation with the 6 working DGs during the administration period; rotate operation to average hours
- Enhance BK1, BK3, BK6, & 7
- Rebuild BK1, BK3, BK6, & BK7 once over the next 4 years

SIP DPP

- 4 DGs are needed
- Continue operation with the 3 working DGs during Admin Period
- Immediately relocate & install 1 spare rebuilt as S1 from Bagh-e-Pol
- Transfer LSIP loads to SIP. Use above to power LSIP loads
- Rebuild S3, S4, and S5
- Enhance S1, S3, S4, and S5
- Rebuild S1, S3, S4, and S5 one additional time over four years

LSIP DPP

- Transfer loads to SIP after installation of S1
- Retire entire LSIP DPP

5.0 OTHER REPORT DOCUMENTS

Appendix E is an automated Excel copy of the normal Bidder Pricing Sheets used for procurement. Please be aware that these Pricing Sheets do not include future line items for expected DG rebuild costs. The Report includes these costs, but the Pricing Sheets are based only on current work necessary to provide the initial upgrades to the existing DGs at Bagh-e-Pol, Breshna Kot and Shorindam Industrial Park.

Appendix F is a specifications sheet for the ERS.

APPENDICES

APPENDIX A
EVALUATION AND SPREADSHEETS

Report Input Data

Item Description	Quantity	Units	Basis
Present Cost of Fuel Oil	\$1.21	\$US/L	Kabul
Enhancement Cost (Large DG)	\$ 276,670	\$US/DG	Bowman
Enhancement Cost (Small DG)	\$ 116,700	\$US/DG	Pro-Rate
Enhancement Energy Production	11.1% of DG kW to 120		Bowman
Cost to Rebuild (Large DG)	\$160,000.00	\$US	Kabul
Cost to Rebuild (Small DG)	\$67,500.00	\$US	Pro-Rate
Cost to Move/Install (Large DG)	\$40,000.00	\$US	Estimate
Time Till T/L Connector Active	4 Years		Kabul
Interim Period Operation	19.7 hr./Day		Kabul
ERS Maintenance Cost	\$1 per hour/DG		Bowman
Increase of DG Fuel Use After Enh	2.00% /kW		Bowman
Pre-Test Costs	\$35,000	\$US, once	Bowman
Training Costs	\$35,000	\$US/DPP	Bowman
Study Review Period	1.00 months		Kabul
Preparation of bid package	1.00 months		Kabul
Bid period	1.00 months		Kabul
Award Period	1.00 months		Kabul
Pre-Test/Baseline Existing DPP	1.00 months		Kabul
Shipping Time	0.75 months		Bowman
Install Time	0.25 months		Bowman
Total Project Delay Time Period	6.00 months		

Enhancement Costs (Large DG) Include

Item	Cost \$	Basis
TG Equipment	200000	Bowman
Enclosure	25000	Bowman
Auto Gas By-Pass	35000	Bowman
Install Material	5000	Estimate
Pre-Test	2,920	1 time/12 DGs
Training	8,750	per DG Enh
Total	\$276,670	(each DG)

Table 1 - Kandahar Area Annual Generation

Cycle #:	Hydro Generation kWh	Diesel Generation kWh	Total Generation kWh
1st Cycle	11,615,960	17,744,600	29,360,560
2nd Cycle	13,184,440	20,122,830	33,307,270
3rd Cycle	8,977,360	20,194,010	29,171,370
4th Cycle	7,815,710	17,904,610	25,720,320
5th Cycle	7,444,561	21,578,310	29,022,871
6th Cycle	7,714,001	19,243,000	26,957,001
Total	56,752,032	116,787,360	173,539,392
Average	9,458,672	19,464,560	28,923,232

Table 3 - Recommendations per DPP Site							
DPP Site	#DG to Rebuild*	#DG to Enhance	Site Program Cost \$*	ERS Savings \$*	Program Return Gain (Loss) \$*	Years to Full PB **	Notes & Project Description
Bagh-e-Pol	6	4	2146680	3361031	1214351	2.74	Immediately move 1 rebuilt spare to SIP to replace LSIP. Install other 3 rebuilt spares in place of failed DGs. Rebuild 2 other failed DGs. Enhance these 4 engines.
Breshna Kot	4	4	1746680	2349833	603153	3.11	Rebuild & enhance 3 of the failed DGs.
SIP	7	4	2266680	3376983	1110303	2.85	Immediately install 1 rebuilt DG from Bagh-e-Pol. Use it to supply LSIP loads via new distribution line (SIP/LSIP). Rebuild 3 failed DGs & then enhance 4 engines.
LSIP	0	0	1411800	1251744	-160056	4.46	Immediately construct distribution tie between LSIP & SIP. Shut down LSIP & transfer existing load to SIP. LSIP can be retired. Costs are NOT part of Totals.
Totals	17	12	\$6,160,040	\$9,087,847	\$2,927,807	2.90	Average time to Full PB**

All costs based on current fuel price.

*=Over 4 Years, includes training.

**=From Now

Table 4 - Field Diesel Generator Base Data Summary

Site Location	Diesel#	Engine Manuf	Engine Model#	Serial Number	Description	Age (yr-mo)	Condition	Hours	Rated kW	Fuel L/Hr	Current (Curtailed) Operation
Bagh-e-Pol	BP1	Caterpillar	3516B	G2W00146	V16, quad Turbos	3-0	Good	17342	1600	288	19.7 Hours/Day @ 1120kW
Bagh-e-Pol	BP2	Caterpillar	3516B	G2W00149	V16, quad Turbos	3-0	Not Oper	15524	1600	0	Not Operational
Bagh-e-Pol	BP3	Caterpillar	3516B	G2W00147	V16, quad Turbos	3-0	Good	21924	1600	288	19.7 Hours/Day @ 1120kW
Bagh-e-Pol	BP4	Caterpillar	3516B	G2W00151	V16, quad Turbos	3-0	Not Oper	20756	1600	0	Not operational
Bagh-e-Pol	BP5	Caterpillar	3516B	G2W00145	V16, quad Turbos	3-0	Not Oper	18710	1600	0	Not operational
Bagh-e-Pol	BP6	Caterpillar	3516B	G2W00144	V16, quad Turbos	3-0	Good	21973	1600	288	19.7 Hours/Day @ 1120kW
Bagh-e-Pol	BP7	Caterpillar	3516B	G2W00148	V16, quad Turbos	3-0	Not Oper	17762	1600	0	Not operational
Bagh-e-Pol	BP8	Caterpillar	3516B	G2W00150	V16, quad Turbos	3-0	Fair	21776	1600	288	19.7 Hours/Day @ 1120kW
Bagh-e-Pol	BP4A	Caterpillar	3516B	G2W00235	V16, quad Turbos	0-0	New	0	1600	288	Rebuilt Site Spare
Bagh-e-Pol	BP5A	Caterpillar	3516B	G2W00236	V16, quad Turbos	0-0	New	0	1600	288	Rebuilt Site Spare
Bagh-e-Pol	BP7A	Caterpillar	3516B	G2W00242	V16, quad Turbos	0-0	New	0	1600	288	Rebuilt Site Spare
Breshna Kot	BK1	MTU	1800FXC5D(G63)	335726-1-13-0911	V16, quad Turbos	2-1	Good	3252	1525	280	19.7 Hours/Day @ 1220kW
Breshna Kot	BK2	MTU	1800FXC5D(G63)	335726-1-6-0911	V16, quad Turbos	2-1	Good	3929	1525	280	19.7 Hours/Day @ 1220kW
Breshna Kot	BK3	MTU	1800FXC5D(G63)	335726-1-5-0911	V16, quad Turbos	2-1	Good	3307	1525	280	19.7 Hours/Day @ 1220kW
Breshna Kot	BK4	MTU	1800FXC5D(G63)	335726-1-4-0911	V16, quad Turbos	2-1	Good	3907	1525	280	19.7 Hours/Day @ 1220kW
Breshna Kot	BK5	MTU	1800FXC5D(G63)	335726-1-14-0911	V16, quad Turbos	2-1	Not Oper	N/A	1525	0	Not Operational
Breshna Kot	BK6	MTU	1800FXC5D(G63)	335726-1-1-0911	V16, quad Turbos	2-1	Good	3297	1525	280	19.7 Hours/Day @ 1220kW
Breshna Kot	BK7	MTU	1800FXC5D(G63)	335726-1-8-0911	V16, quad Turbos	2-1	Good	2601	1525	280	19.7 Hours/Day @ 1220kW
SIP	S1	Caterpillar	3516B	G6A00730	V16, quad Turbos	3-0	Not Oper	21458	1600	0	Not Operational
SIP	S2	Caterpillar	3516B	G6A00723	V16, quad Turbos	3-0	Good	21584	1600	288	19.7Hr/Day @ 1120kW
SIP	S3	Caterpillar	3516B	G6A00726	V16, quad Turbos	3-0	Not Oper	17560	1600	0	Not Operational
SIP	S4	Caterpillar	3516B	G6A00727	V16, quad Turbos	3-0	Not Oper	17842	1600	0	Not Operational
SIP	S5	Caterpillar	3516B	G6A00763	V16, quad Turbos	3-0	Not Oper	19244	1600	0	Not Operational
SIP	S6	Caterpillar	3516B	G6A00729	V16, quad Turbos	3-0	Not Oper	21641	1600	0	Not Operational
SIP	S7	Caterpillar	3516B	G6A00728	V16, quad Turbos	3-0	Good	20938	1600	288	19.7Hr/Day @ 1120kW
SIP	S8	Caterpillar	3516B	G6A00724	V16, quad Turbos	3-0	Good	20336	1600	288	19.7Hr/Day @ 1120kW
Little SIP	LS1	Cummins	QSC23-G3	0228291/007	V6, 1 turbo	2-0	Not Oper	5951	648	0	Not Operational
Little SIP	LS2	Cummins	QSC23-G3	0228291/003	V6, 1 turbo	2-0	Not Oper	5851	648	0	Not Operational
Little SIP	LS3	Cummins	QSC23-G3	0217753/002	V6, 1 turbo	2-0	Not Oper	5604	648	0	Not Operational
Little SIP	LS4	Cummins	QSC23-G3	0221009/005	V6, 1 turbo	2-0	Not Oper	5550	648	0	Not Operational
Little SIP	LS5	Cummins	QSC23-G3	0228291/009	V6, 1 turbo	2-0	Not Oper	4940	648	0	Not Operational
Little SIP	LS6	Cummins	QSC23-G3	0221009/007	V6, 1 turbo	2-0	Not Oper	6021	648	0	Not Operational
Little SIP	LS7	Cummins	QSC23-G3	0221296/004	V6, 1 turbo	2-0	Fair	7104	648	185	24Hr/Day @ 600kW
Little SIP	LS8	Cummins	QSC23-G3	0228291/005	V6, 1 turbo	2-0	Fair	7212	648	185	24Hr/Day @ 600kW
Little SIP	LS9	Cummins	QSC23-G3	0221067/001	V6, 1 turbo	2-0	Not Oper	5811	648	0	Not Operational
Little SIP	LS10	Cummins	QSC23-G3	02210066/003	V6, 1 turbo	2-0	Not Oper	3929	648	0	Not Operational

Table 5 - Operating Estimate for BK							
Period	Kajaki Hydro kwh/cy	BK for Kaj kwh/cy	Hourly kw Demand	Trans From Other Grid	Total BK Demand	#Gen@1220 Appx	Avg kW per Gen
1	11615960	1568480	1089	1073	2163	2	1081
2	13184440	0	0	3814	3814	4	954
3	8977360	4207080	2922	942	3864	4	966
4	7815710	5368730	3728	0	3728	4	932
5	7444561	5739879	3986	839	4825	4	1206
6	7714001	5470439	3799	0	3799	4	950

Totals 56752032

Total Diesel/yr across = 116787360

31957319

Total DG From Study = 116787360

[Redacted] = Data from Initial Study

Table 6 - Operating Estimate for BP & SIP & LSIP															
Total DG kWh/cy	BK for Kaj kWh/cy	From LSIP kwh/cy	Remaing BK+SIP Gen	Max from BP+SIP	Trans to BK kwh/cy	Trans to BK Grid	BP+SIP kwh/cy	Proportional BP kwh/cy	Proportional SIP kwh/cy	Proportional Demand BP Gen kw	Proportional Demand SIP Gen kw	Per Site #DG@1280		Avg kW/Gen	
												BP	SIP	BP	SIP
17744600	1568480	1728000	14448120	12902400	1545720	1073	12902400	7372800	5529600	5120	3840	4	3	1280	1280
20122830	0	1728000	18394830	12902400	5492430	3814	12902400	7372800	5529600	5120	3840	4	3	1280	1280
20194010	4207080	1728000	14258930	12902400	1356530	942	12902400	7372800	5529600	5120	3840	4	3	1280	1280
17904610	5368730	1728000	10807880	12902400	0	0	10807880	6175931	4631949	4289	3217	4	3	1072	1072
21578310	5739879	1728000	14110431	12902400	1208031	839	12902400	7372800	5529600	5120	3840	4	3	1280	1280
19243000	5470439	1728000	12044561	12902400	0	0	12044561	6882606	5161955	4780	3585	4	3	1195	1195

116787360

10368000

42549738 31912303

Table 7 - Operating Estimate for SIP, LSIP Retired					
Period	Prior SIP kW	Transfer LSIP kW	New SIP kW	#DG@1280 Required	Gen Load kW
1	3840	1200	5040	4	1260
2	3840	1200	5040	4	1260
3	3840	1200	5040	4	1260
4	3217	1200	4417	4	1104
5	3840	1200	5040	4	1260
6	3585	1200	4785	4	1196

Table 8 - Large DG Fuel Use					
Gen kW	Fuel Use - Gal/Hr - Large DG				Data
	25% Load	50% Load	75% Load	100% Load	Source
1500	32.2	54.3	77.8	106.5	Data Sheet
1600	34.7	56.8	80.3	109	Pro-Rate
1750	37.5	63.2	90.7	124.2	Data Sheet

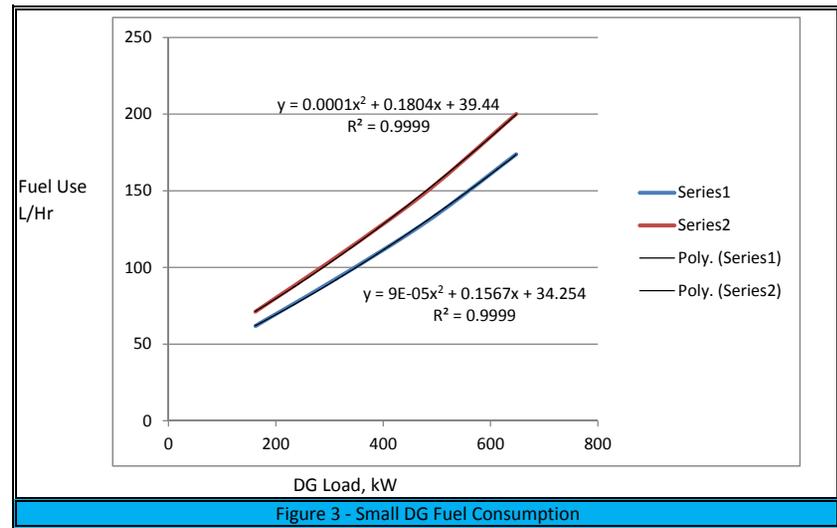
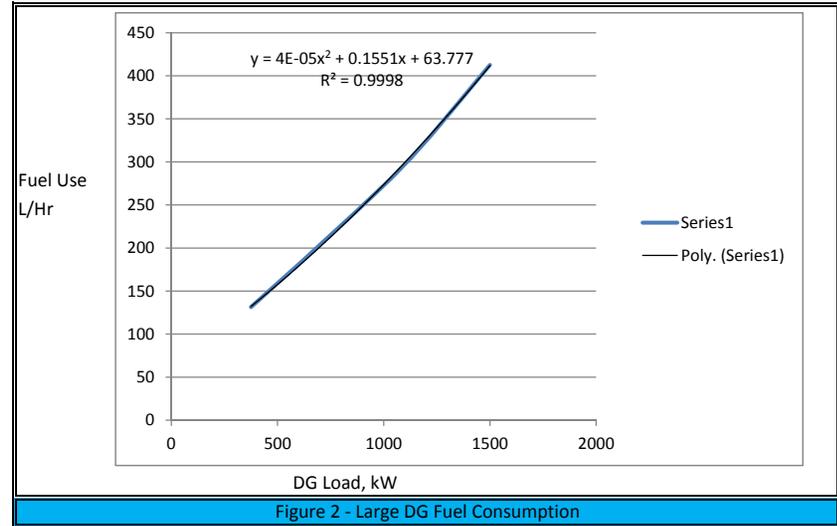
Table 9 - 1600kW DG Fuel Use				
Use L/Hr	Fuel Use - L/Hr			
	Output	131.3395	214.988	303.9355
	375	750	1125	1500

Table 10 - 1600kW DG Fuel Use Curve Calibration				
Data From	kW	L/Hr	Factor	Notes
Graph	1120	287.665	1.001165	No Factor Necessary
Field	1120	288	N/A	N/A

Table 11 - Small DG Fuel Use					
Gen kW	Fuel Use - Gal/Hr - Small DG				Source
	25% Load	50% Load	75% Load	100% Load	Source
600	13.2	22	31.5	42.8	Data Sheet
648	16.325	25.125	34.625	45.925	Pro-Rate
750	16.3	27.4	39.3	53.4	Data Sheet

Table 12 - 648kW DG Fuel Use				
Use L/Hr	Fuel Use - L/Hr			
	Output	61.79013	95.09813	131.0556
	162	324	486	648

Table 13 - 648kW DG Fuel Use Curve Calibration				
Data From	kW	L/Hr	Factor	Notes
Graph	600	160.674	1.1514	Requires a 15.14% Factor
Field	600	185	N/A	N/A
Corrected	71.14513	109.496	150.8974	200.1433532



Little SIP Analysis

If Continued to be Used

Table 14 - LSIP DPP Evaluation											
Period	Site #DG@600kW	Site Avg kW/DG	ERS Power kW	Post-Enh DG Power kW	Std Fuel Use L/Hr/DG	Enh Fuel Use L/Hr/DG	Savings L/Hr/DG	DPP Efficiency Improvement %	DPP Savings L/Hr	DPP Savings \$/Hr	
1	2	600	60	540	183.7	166.0	17.7	9.62%	35.3	\$42.75	
2	2	600	60	540	183.7	166.0	17.7	9.62%	35.3	\$42.75	
3	2	600	60	540	183.7	166.0	17.7	9.62%	35.3	\$42.75	
4	2	600	60	540	183.7	166.0	17.7	9.62%	35.3	\$42.75	
5	2	600	60	540	183.7	166.0	17.7	9.62%	35.3	\$42.75	
6	2	600	60	540	183.7	166.0	17.7	9.62%	35.3	\$42.75	
	2	Max # of DGs Required									
						Annual PP Fuel Efficiency Improvement			9.62	%	
						Average Fuel Saved			35.328	L/Hr	
						Average Fuel Cost Saved			42.75	\$/Hr	
						Average Annual Maintenance Costs			2.00	\$/Hr	
						Annual Fuel Saved			309473.28	L/Yr	
						Annual ERS Cost Savings			356942.669	\$/Yr	
						Enhancement Payback Period			1.31	Years	

Table 15 - LSIP Project Costs			
Item Description	Quantity	Cost Each	Cost \$
Rebuild DG	14	67,500	945000
Enhance DG	4	116,700	466800
	Total		1411800

Based on 5457 between rebuilds

After Enhancement running hours to Full Payback 34648.05158 Includes all work

Full Project years to Payback Incl Admin Period) 4.46 Years from now.

Table 16 - LSIP Project Term Value	
Days Till NEPS/SEPS Connector Active	1460
Admin Period Days	180
Days of Enhanced Generation	1280
Total Fuel Cost Savings	\$1,251,744
Basic Return on Investment	-11.3%

BP Analysis

Table 17 - BP DPP Evaluation										
Period	Site #DG@1480kW	Site Avg kW/DG	ERS Power kW	Post-Enh DG Power kW	Std Fuel Use L/Hr/DG	Enh Fuel Use L/Hr/DG	Savings L/Hr/DG	DPP Efficiency Improvement %	DPP Savings L/Hr	DPP Savings \$/Hr
1	4	1280	120	1160	327.8	303.6	24.3	7.40%	97.0	\$117.38
2	4	1280	120	1160	327.8	303.6	24.3	7.40%	97.0	\$117.38
3	4	1280	120	1160	327.8	303.6	24.3	7.40%	97.0	\$117.38
4	4	1072	106	967	276.1	256.2	19.9	7.20%	79.6	\$96.26
5	4	1280	120	1160	327.8	303.6	24.3	7.40%	97.0	\$117.38
6	4	1195	119	1076	306.2	282.5	23.7	7.74%	94.8	\$114.66
	4	Max # of DGs Required								
						Annual PP Fuel Efficiency Improvement			7.42	%
						Average Fuel Saved			93.7260801	L/Hr
						Average Fuel Cost Saved			113.41	\$/Hr
						Average Annual Maintenance Costs			4.00	\$/Hr
						Annual Fuel Saved			821040.461	L/Yr
						Annual ERS Cost Savings			958418.958	\$/Yr
						Enhancement Payback Period			1.15	Years

Table 18 - BP Project Costs			
Item Description	Quantity	Cost Each	Cost \$
Relocate/Install RB DG	2	40,000	80000
Rebuild DG	6	160,000	960000
Enhance DG	4	276,670	1106680
	Total		\$2,146,680

Based on 18944 between rebuilds

After Enhancement running hours to Full Payback 19,621 Includes all work

Full Project years to Payback Incl Admin Period) 2.74 Years from now.

Table 19 - BP Project Term Value	
Days Till NEPS/SEPS Connector Active	1460
Admin Period Days	180
Days of Enhanced Generation	1280
Total Cost Savings	\$3,361,031
Basic Return on Investment	56.6%

BK Analysis

Table 20 - BK DPP Evaluation										
Period	Site #DG@1200kW	Site Avg kW/DG	ERS Power kW	Post-Enh DG Power kW	Std Fuel Use L/Hr/DG	Enh Fuel Use L/Hr/DG	Savings L/Hr/DG	DPP Efficiency Improvement %	DPP Savings L/Hr	DPP Savings \$/Hr
1	2	1081	107	975	278.3	258.1	20.2	7.25%	40.3	\$48.80
2	4	954	93	861	248.0	231.6	16.4	6.63%	65.7	\$79.54
3	4	966	94	872	250.9	234.1	16.8	6.69%	67.1	\$81.23
4	4	932	90	842	243.1	227.3	15.8	6.51%	63.3	\$76.63
5	4	1206	120	1086	309.1	285.2	23.9	7.74%	95.7	\$115.74
6	4	950	92	858	247.2	230.8	16.3	6.61%	65.3	\$79.02
	4	Max # of DGs Required								
						Annual PP Fuel Efficiency Improvement			6.87	%
						Average Fuel Saved			66.2468035	L/Hr
						Average Fuel Cost Saved			80.16	\$/Hr
						Average Annual Maintenance Costs			3.67	\$/Hr
						Annual Fuel Saved			580321.999	L/Yr
						Annual ERS Cost Savings			670069.618	\$/Yr
						Enhancement Payback Period			1.65	Years

Table 21 - BK Project Costs			
Item Description	Quantity	Cost Each	Cost \$
Rebuild DG	4	160,000	640000
Enhance DG	4	276,670	1106680
	Total		1746680

Based on 18944 between rebuilds

After Enhancement running hours to Full Payback 22834.81653 Includes all work

Full Project years to Payback Incl Admin Period) 3.11 Years from now.

Table 22 - BK Project Term Value	
Days Till NEPS/SEPS Connector Active	1460
Admin Period Days	180
Days of Enhanced Generation	1280
Total Fuel Cost Savings	\$2,349,833
Basic Return on Investment	34.5%

SIP Analysis

If LSIP S/D , load to SIP

Table 23 - SIP DPP Evaluation										
Period	Site #DG@1200kW	Site Avg kW/DG	ERS Power kW	Post-Enh DG Power kW	Std Fuel Use L/Hr/DG	Enh Fuel Use L/Hr/DG	Savings L/Hr/DG	DPP Efficiency Improvement %	DPP Savings L/Hr	DPP Savings \$/Hr
1	4	1260	120	1140	322.7	298.5	24.2	7.49%	96.6	\$116.94
2	4	1260	120	1140	322.7	298.5	24.2	7.49%	96.6	\$116.94
3	4	1260	120	1140	322.7	298.5	24.2	7.49%	96.6	\$116.94
4	4	1104	109	995	283.8	262.9	20.9	7.35%	83.4	\$100.95
5	4	1260	120	1140	322.7	298.5	24.2	7.49%	96.6	\$116.94
6	4	1196	119	1077	306.5	282.8	23.7	7.74%	94.9	\$114.86
	4	Max # of DGs Required								
						Annual PP Fuel Efficiency Improvement			7.51	%
						Average Fuel Saved			94.15522089	L/Hr
						Average Fuel Cost Saved			113.93	\$/Hr
						Average Annual Maintenance Costs			4.00	\$/Hr
						Annual Fuel Saved			998007.6793	L/Yr
						Annual ERS Cost Savings			962967.6793	\$/Yr
						Enhancement Payback Period			1.15	Years

Table 24 - SIP Project Costs			
Item Description	Quantity	Cost Each	Cost \$
Relocate/Install RB DG	1	40,000	40000
Rebuild DG	7	160,000	1120000
Enhance DG	4	276,670	1106680
	Total		\$2,266,680

Based on 18944 between rebuilds

After Enhancement running hours to Full Payback 20,620 Includes all work

Full Project years to Payback Incl Admin Period) 2.85 Years from now.

Table 25 - SIP Project Term Value	
Days Till NEPS/SEPS Connector Active	1460
Admin Period Days	180
Days of Enhanced Generation	1280
Total Fuel Cost Savings	\$3,376,983
Basic Return on Investment	49.0%

Effect of Fuel Cost

Table 26 - Fuel Cost Effect				
Site	BP DPP	BK DPP	SIP DPP	Totals
Total Program Costs, \$	2,146,680	1,746,680	2,266,680	6,160,040
DPP Fuel Saved L/Year	821,040	580,322	998,008	2,399,370
	Fuel Cost	Years to FPB		
	\$/L	after Enh		
	0.7	3.67		
	0.8	3.21		
	0.9	2.85		
	1	2.57		
	1.1	2.33		
	1.2	2.14		
	1.3	1.97		
	1.4	1.83		
	1.5	1.71		
	1.6	1.60		

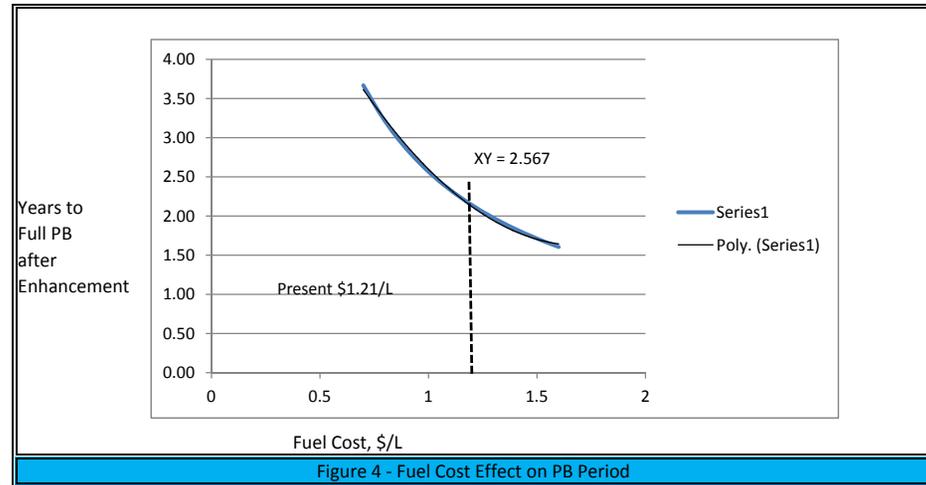


Figure 4 - Fuel Cost Effect on PB Period

APPENDIX B
TYPICAL ENERGY RECOVERING TURBO GENERATORS

The following pages provide a better description of the Energy Recovery System (ERS) in the form of an exhaust heat Turbo-Generator system with 50Hz power conversion.

Improve the fuel efficiency & CO2 emissions of your Diesel / Gas Generators



Oil & Gas



Mining



**Off-grid
utilities**



**Typical Applications
And many other applications ...**

Biogas



Desalination Pumps



Dredging



Biodiesel



Oil & Gas Stations



Landfill Gas



Gensets expenses are in the fuel

Example



Typical Diesel genset 1500kVA / 1200kWe

(CAT 3512B, Cummins KTA-50...)

CAPEX ~ 0.3-0.5 M\$

If running continuously @ 80% load with diesel @ 1\$/litre

OPEX (fuel): 2M\$ / year (*\$10M in 5 years*)



At 6-8% typical savings:
120-160k\$ / year*

We use your exhaust gases to increase engine efficiency



6-8%

Reduce Fuel
Consumption

Payback (12-24 months)

OR

Increase power
output

6-8%

+

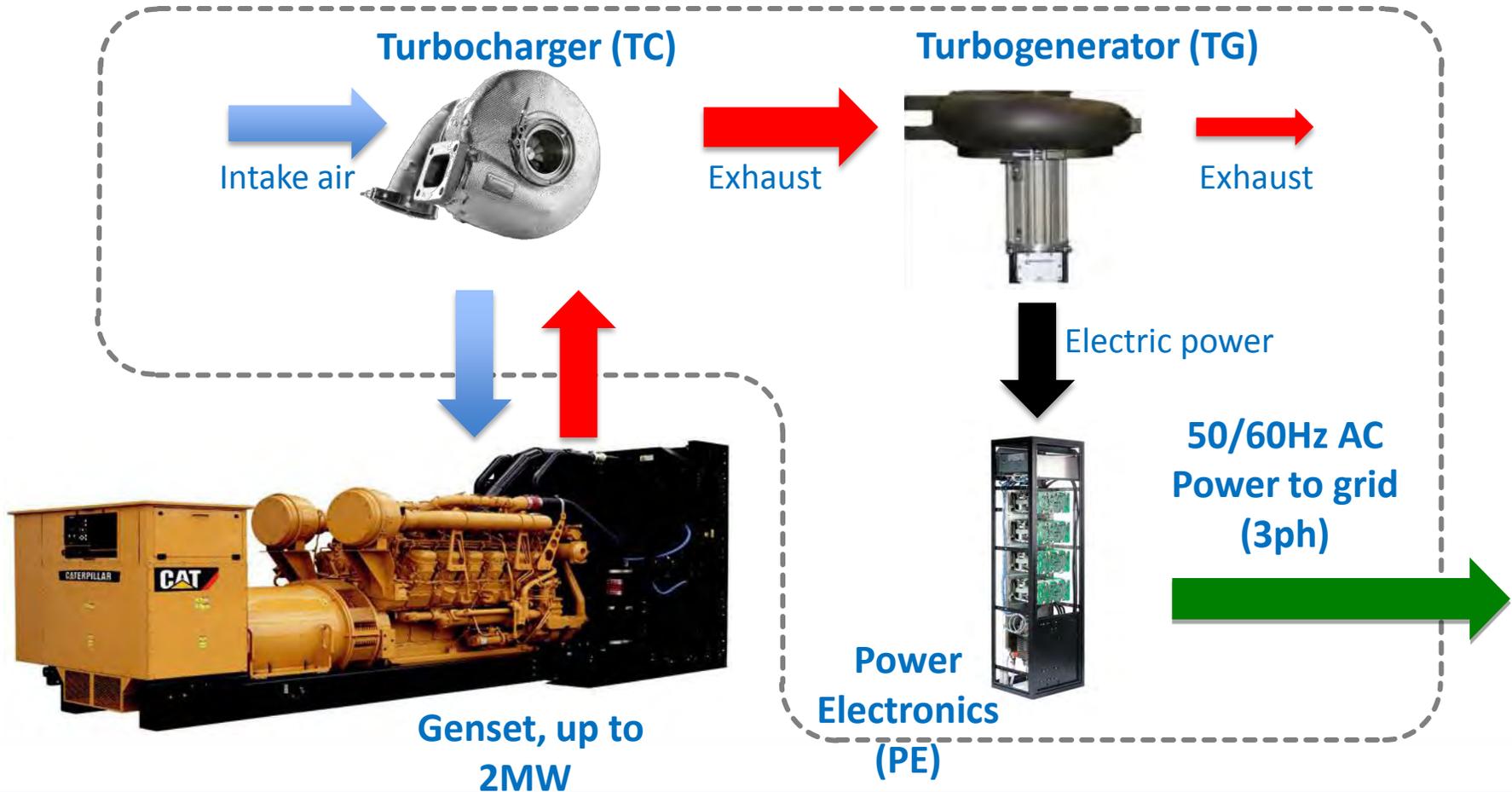
Reduce CO2
emissions

6-8%

**No change in
your operations**

Quick installation, no
extra activities

Recover electrical power from your exhaust



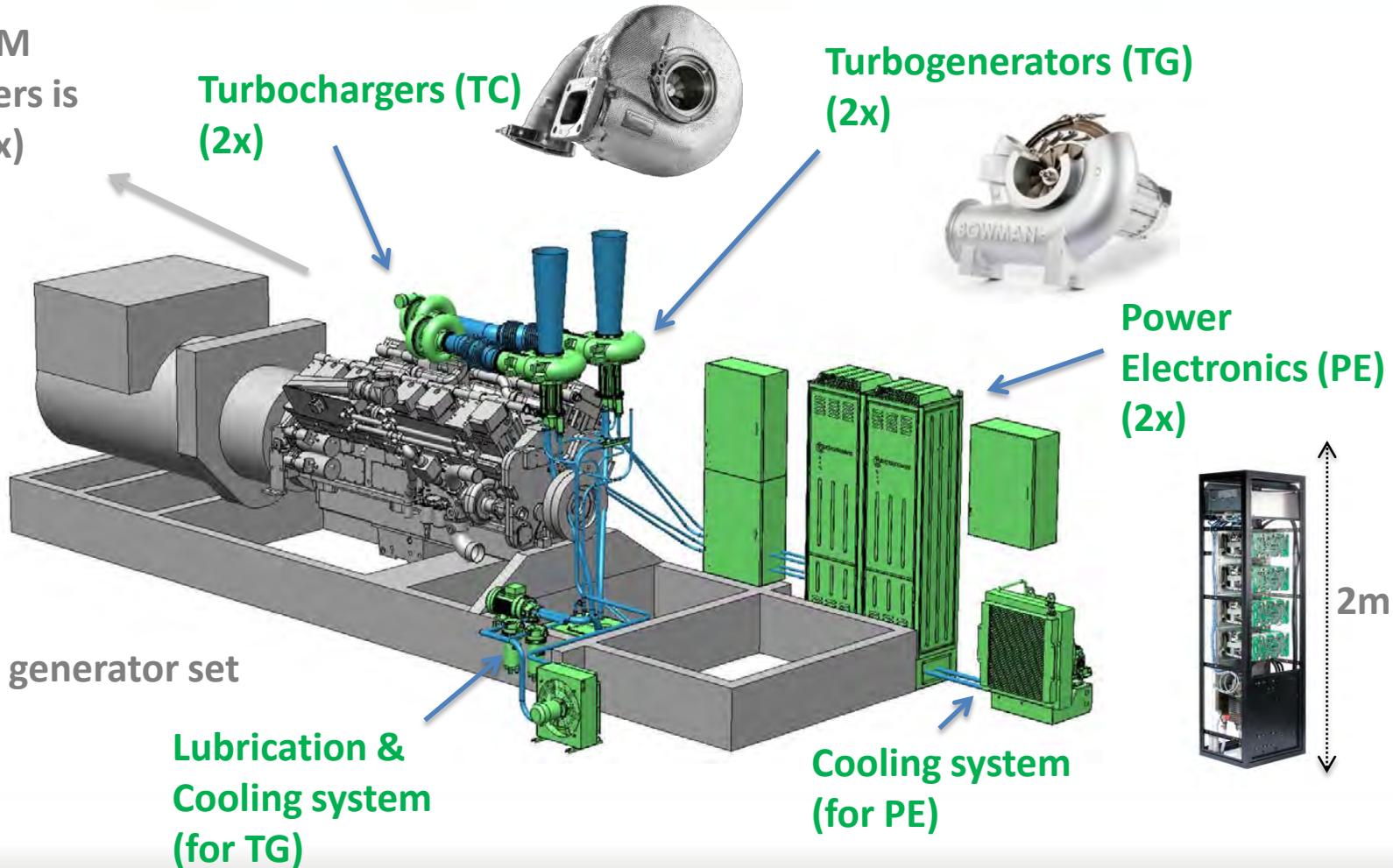
Main equipment & main sub-elements (600kW-1.5MW genset)

Original OEM turbochargers is replaced (2x)

Turbochargers (TC) (2x)

Turbogenerators (TG) (2x)

Power Electronics (PE) (2x)



System installed with just 48-96 hours of downtime*

- Flexible installation solutions to suit every customer site
 - on/around the engine
 - open sets or containerized generators
- Installation & commissioning is supervised by a Bowman Service engineer
- Connections & synchronisation to the “local” electrical 3ph grid
- Our service experts will train your engineers on commissioning, service & maintenance





Maintenance aligned with schedule from OEM

Same people at the same time !

Maintenance Items	Service time				
	Daily	Weekly	Monthly	6 Months	Yearly
Inspection	X				
Check coolant heater	X				
Check coolant level	X				
Check oil level	X				
Check fuel level	X				
Check charge-air piping	X				
Check/clean air cleaner		X			
Check battery charger		X			
Drain fuel filter		X			
Drain water from fuel tank		X			
Check coolant concentration			X		
Check drive belt tension			X		
Drain exhaust condensate			X		
Check starting batteries			X		
Change oil and filter				X	
Change coolant filter				X	
Clean crankcase breather				X	
Change air cleaner element				X	
Check radiator hoses				X	
Change fuel filters				X	
Clean cooling system					X

Drain water from tank

Check Oil

Check coolant system

Inspect & clean turbine

Change oil filters

Clean compressor & power electronics

Check of the Turbocharger
Bearing replacement for TG
Coolant change

Remote Monitoring possible



Recondition Turbocharger unit

(every 2 years)

Typical diesel generator Maintenance Schedule

- **Fuel savings 6-8%**
- **Payback in 12-24 months**
- **Reduced CO₂ emissions**
- **Proven, reliable, technology**



Do you want to be running the most efficient, lowest-emission gensets ?

The following pages show a typical ERS installation on an existing Caterpillar diesel generating set.



'Host' Engine Before Installation



Hardware Arrival (for 2 Engines)



Turbochargers removed



TG Mounting Frame Goes On



TG Oil System



Power Electronics



Control Electronics



TGs on Engine Inside Container



Generating!!



Installation & Commissioning Complete

- Performance proven on reference site:
 - 6.5% reduction in bsfc @ 1250kWe
 - System fully integrated within original genset container (40')
 - Following detailed design of integration parts and integration proving on 1st system, installation takes ~1wk



APPENDIX C
FIELD SURVEY REPORTS

APPENDIX C.1
FIELD SURVEY RESULTS AT BAGH-E-POL

DIESEL GENERATOR INSPECTION FORM

G-1 Baghi-e-Pul

1.0 GENERAL

1.1 Inspection Date: 17/11/2014

1.2 Site Location : Baghi- e -Pul

1.3 Site Description (Including total number of Gensets): Baghi-e-Pul diesel power plant is located on Kandahar Herat highway east of Kandahar, there are 8 units diesel generators 2000kVA, 50HZ, 400V, 3phase each.

1.4 Investigators :

a.

b.

c.

d.

1.5 Pow

1.6 Diesel Generator Number: No, 1

1.7 GPS Coordinate: 31.614596°, 65.585948°

1.8 Genset General Condition: Functional

1.9 Genset age(Year of installation): November, 2011

DIESEL GENERATOR INSPECTION FORM

G-1 Baghi-e-Pul

2.0 GENERATORS DATA

- 2.1 Manufacturer: CATERPILLAR
- 2.2 Serial Number: G2W00146
- 2.3 Model Number: SR5
- 2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 16 cylinders generator and feed by the diesel fuel and has 4 turbo systems 2 turbo each side.
- 2.5 Output Power Rating 1600kW, 2000KVA
- 2.6 Operation Condition: Good Fair Not Operational
- 2.7 Condition Notes: The overall generator is good. This generator is functional. The generator runs 5PM to 12AM local time. This generator operated and maintenance by DABS. DABS 70% load this generator.
- 2.8 Operating Hours: 17342
- 2.9 Fuel Usage (Litters/hours): 288Litters/ Hour according to power plant manager
- 2.10 Typical Operation (Hours/day, continues, standby, load etc.): 7 Hours/Day
- 2.11 Maintenance Records: (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.
250 Hours maintenance: Clean the air filter, oil filter and clean the engine.
500 Hours maintenance: Change the air filter, oil filter and engine oil.
18000 Hours maintenance: General Service of the generator, which maintenance team doesn't have enough spear part for the general service.
- 2.12 Present Engine Running Period: 17342 hours
- 2.13 Turbo Charger Installation Possibility: presently there are four turbo are installed in this generator as depicted in the pictures.

3.0 SITE

- 3.1 GENERAL
- a. Yard Type (flat, sloped, stepped): Flat
- 3.2 DRAINAGE
- a. Type of System (surface or closed): Closed
- 3.3 YARD SURFACING MATERIAL

DIESEL GENERATOR INSPECTION FORM
G-1 Baghi-e-Pul

- a. Material:
 - 3.3.a.1 Type: concrete
 - 3.3.a.2 Size: (44x80)m
- 3.4 SECURITY FENCE
 - a. Height: N/A
 - b. Fabric Material: N/A
 - c. Vehicle Gates (itemize as listed below for each size gate):
 - d. Size: 2.8-4.0 m
 - e. Quantity: 1

DIESEL GENERATOR INSPECTION FORM

G-1 Baghi-e-Pul

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House: This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

Generator House Ventilation System Description: Outdoor

4.2 EXTERNAL DIMENSIONS

- a. Length: 12.30 m
- b. Width: 2.40 m
- c. Clear Height: 3 m

4.3 SUPERSTRUCTURE

- a. Type (pre-engineered metal or concrete block): N/A
- b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM
G-1 Baghi-e-Pul

5.0 GROUNDING

5.1 GROUND CONNECTIONS

- a. Steel:
 - 5.1.a.1 Type Conductor: N/A
 - 5.1.a.2 Size: N/A
 - 5.1.a.3 Connector: N/A
- b. Equipment:
 - 5.1.b.1 Type Conductor: Copper conductor
 - 5.1.b.2 Size: N/A
 - 5.1.b.3 Connector: Yes
- c. Fence:
 - 5.1.c.1 Type Conductor: N/A
 - 5.1.c.2 Size: N/A
 - 5.1.c.3 Connector: N/A

6.0 RACEWAYS

6.1 Conduit: N/A

- a. Material _____
- b. Size _____ cm (_____ in.)

6.2 Duct Bank: N/A

- a. Size
 - 6.2.a.1 Material: _____
 - 6.2.a.2 Width _____ m (_____ ft)
 - 6.2.a.3 Depth _____ m (_____ ft)
 - 6.2.a.4 Size of conduits _____ cm (_____ in.)

6.3 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete):
Cast-in-place concrete
 - 6.3.a.1 Width _____ cm (_____ in.)
 - 6.3.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM
G-1 Baghi-e-Pul

7.0 CORROSION

7.1 CATHODIC PROTECTION SYSTEM: N/A

7.2 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8.0 DC SYSTEM

a. Nominal: Voltage 24 volts

b. Battery:

8.1.b.1 Cell type: Wet type battery

8.1.b.2 Number of cells: 2 cells

8.1.b.3 Battery Charger (describe): LaMARCHE A12B Battery charger

8.1.b.4 DC amps: N/A

9.0 CONTROL HOUSE

9.1 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

a. Power line carrier

b. Audio tone

c. Carrier or audio tone on shield wire

d. Microwave (analog, digital, or MAS): Mobile Cell Phone

e. Fiber optics

f. Wire lines

10.0 Any Other Information: This generator requires general services.

DIESEL GENERATOR INSPECTION FORM

G-2 Baghi-e-Pul

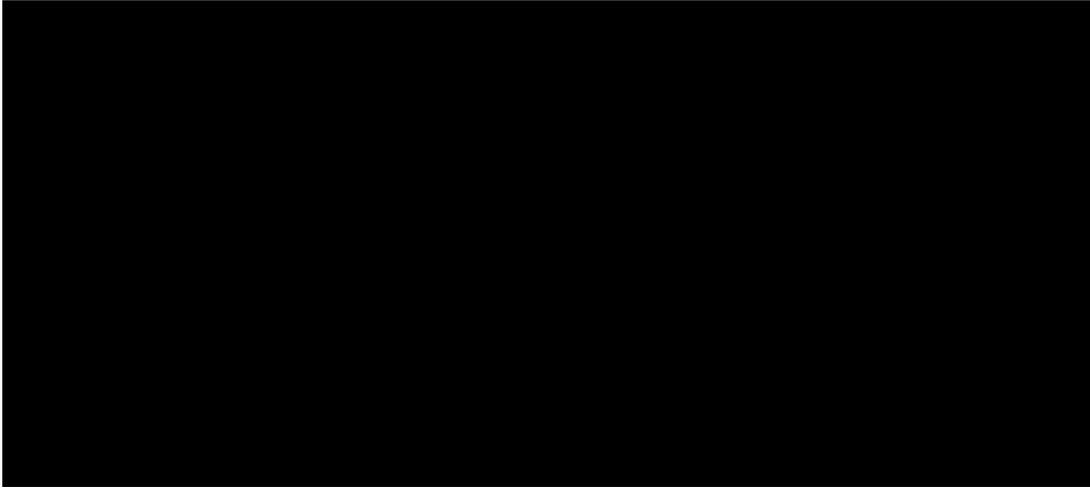
1.0 GENERAL

1.1 Inspection Date: 17/11/2014

1.2 Site Location : Baghi- e -Pul

1.3 Site Description (Including total number of Gensets): Baghi-e-Pul diesel power plant is located on Kandahar Herat highway east of Kandahar, there are 8 units diesel generators 2000kVA, 50HZ, 400V, 3phase each.

1.4 Investigators :



1.6 Diesel Generator Number: No, 2

1.7 GPS Coordinate: 31.614596°, 65.585948°

1.8 Genset General Condition: Nonfunctional

1.9 Genset age(Year of installation): November, 2011

DIESEL GENERATOR INSPECTION FORM

G-2 Baghi-e-Pul

2.0 GENERATORS DATA

- 2.1 Manufacturer: CATERPILLAR
- 2.2 Serial Number: G2W00149
- 2.3 Model Number: SR5
- 2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 16 cylinders generator and feed by the diesel fuel and has 4 turbo systems 2 turbo each side.
- 2.5 Output Power Rating 1600kW, 2000KVA
- 2.6 Operation Condition: Good Fair Not Operational
- 2.7 Condition Notes: This generator is not functional, have engine problem.
- 2.8 Operating Hours: 15524
- 2.9 Fuel Usage (Litters/hours): N/A
- 2.10 Typical Operation (Hours/day, continues, standby, load etc.): N/A
- 2.11 Maintenance Records: (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.
250 Hours maintenance: Clean the air filter, oil filter and clean the engine.
500 Hours maintenance: Change the air filter, oil filter and engine oil.
18000 Hours maintenance: General Service of the generator, which maintenance team doesn't have enough spear part for the general service.
- 2.12 Present Engine Running Period: 15524 hours
- 2.13 Turbo Charger Installation Possibility: Presently there are four turbo are installed in this generator as depicted in the pictures.

3.0 SITE

- 3.1 GENERAL
 - a. Yard Type (flat, sloped, stepped): Flat
- 3.2 DRAINAGE
 - a. Type of System (surface or closed): Closed
- 3.3 YARD SURFACING MATERIAL
 - a. Material:
 - 3.3.a.1 Type: concrete
 - 3.3.a.2 Size: (44x80)m

DIESEL GENERATOR INSPECTION FORM
G-2 Baghi-e-Pul

3.4 SECURITY FENCE

- a. Height: N/A
- b. Fabric Material: N/A
- c. Vehicle Gates (itemize as listed below for each size gate):
- d. Size: 2.8-4.0 m
- e. Quantity: 1

DIESEL GENERATOR INSPECTION FORM
G-2 Baghi-e-Pul

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House: This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

Generator House Ventilation System Description: Outdoor

4.2 EXTERNAL DIMENSIONS

- a. Length: 12.30 m
- b. Width: 2.40 m
- c. Clear Height: 3 m

4.3 SUPERSTRUCTURE

- a. Type (pre-engineered metal or concrete block): N/A
- b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM
G-2 Baghi-e-Pul

5.0 GROUNDING

5.1 GROUND CONNECTIONS

- a. Steel:
 - 5.1.a.1 Type Conductor: N/A
 - 5.1.a.2 Size: N/A
 - 5.1.a.3 Connector: N/A
- b. Equipment:
 - 5.1.b.1 Type Conductor: Copper conductor
 - 5.1.b.2 Size: N/A
 - 5.1.b.3 Connector: Yes
- c. Fence:
 - 5.1.c.1 Type Conductor: N/A
 - 5.1.c.2 Size: N/A
 - 5.1.c.3 Connector: N/A

6.0 RACEWAYS

6.1 Conduit: N/A

- a. Material _____
- b. Size _____ cm (_____ in.)

6.2 Duct Bank: N/A

- a. Size
 - 6.2.a.1 Material: _____
 - 6.2.a.2 Width _____ m (_____ ft)
 - 6.2.a.3 Depth _____ m (_____ ft)
 - 6.2.a.4 Size of conduits _____ cm (_____ in.)

6.3 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete):
Cast-in-place concrete
 - 6.3.a.1 Width _____ cm (_____ in.)
 - 6.3.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM
G-2 Baghi-e-Pul

7.0 CORROSION

7.1 CATHODIC PROTECTION SYSTEM: N/A

7.2 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8.0 DC SYSTEM

a. Nominal: Voltage 24 volts

b. Battery:

8.1.b.1 Cell type: Wet type battery

8.1.b.2 Number of cells: 2 cells

8.1.b.3 Battery Charger (describe): LaMARCHE A12B Battery charger

8.1.b.4 DC amps: N/A

9.0 CONTROL HOUSE

9.1 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

a. Power line carrier

b. Audio tone

c. Carrier or audio tone on shield wire

d. Microwave (analog, digital, or MAS): Mobile Cell Phone

e. Fiber optics

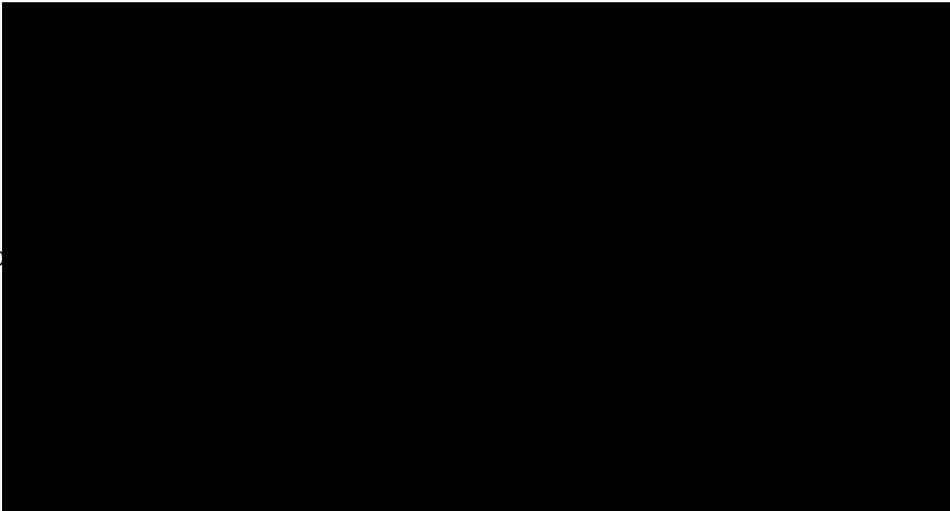
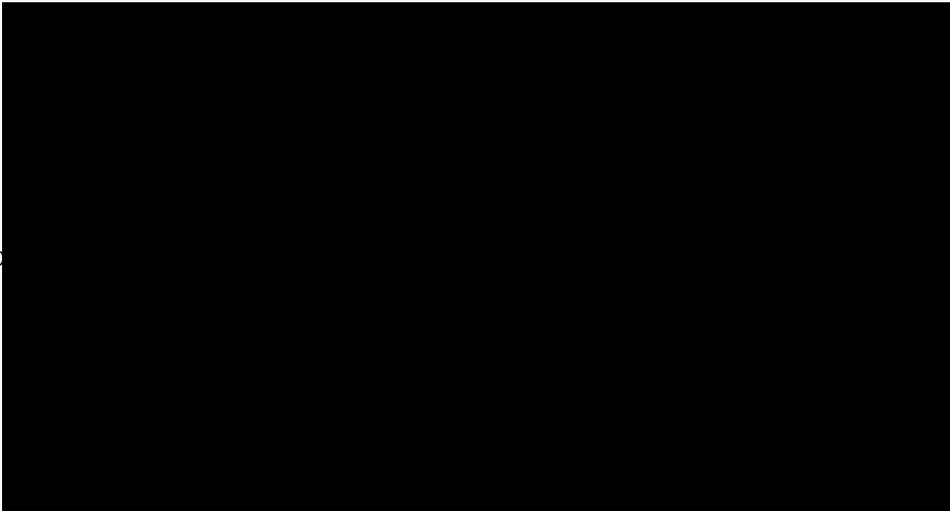
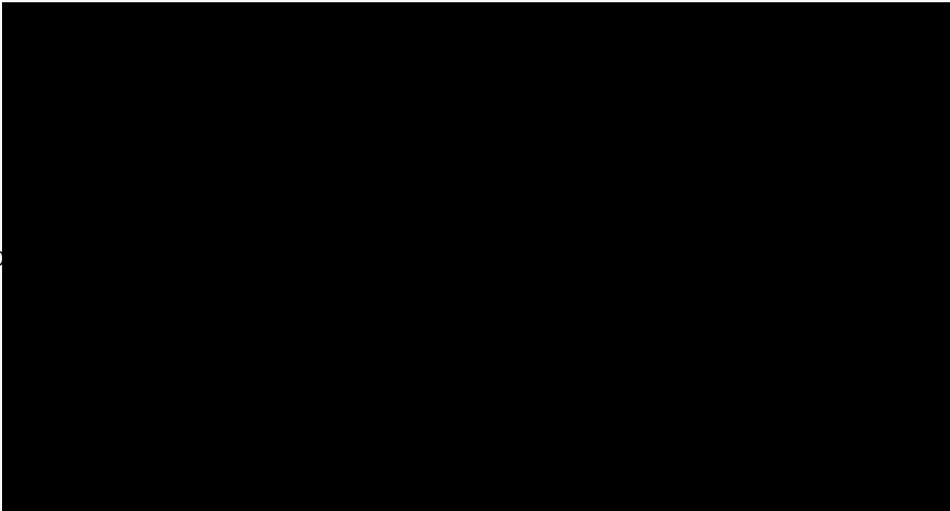
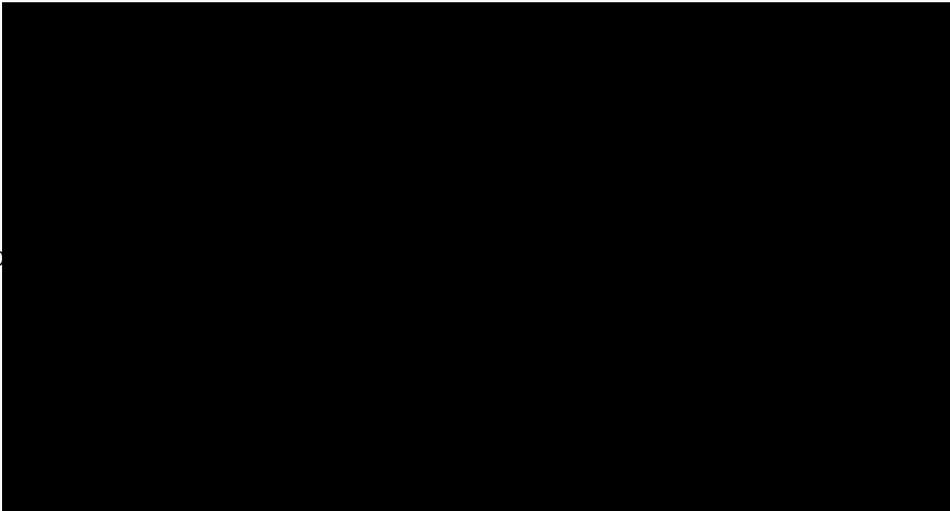
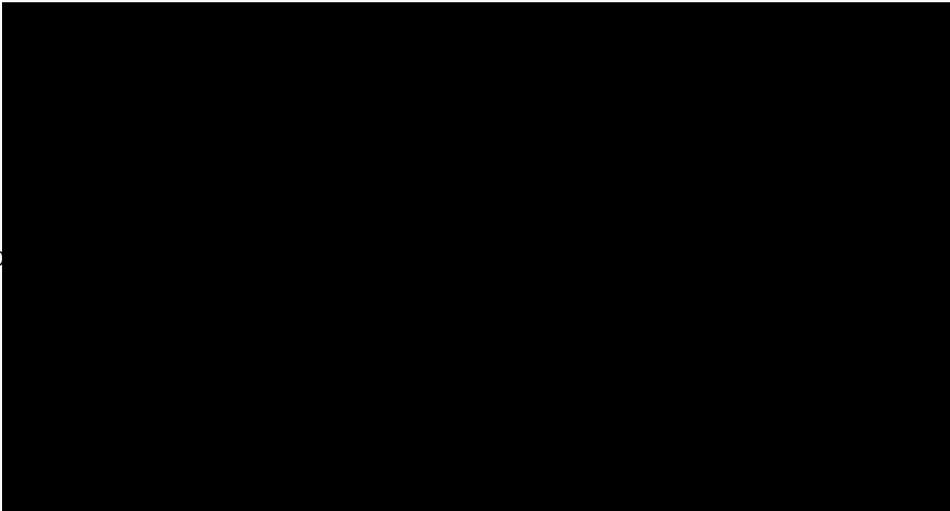
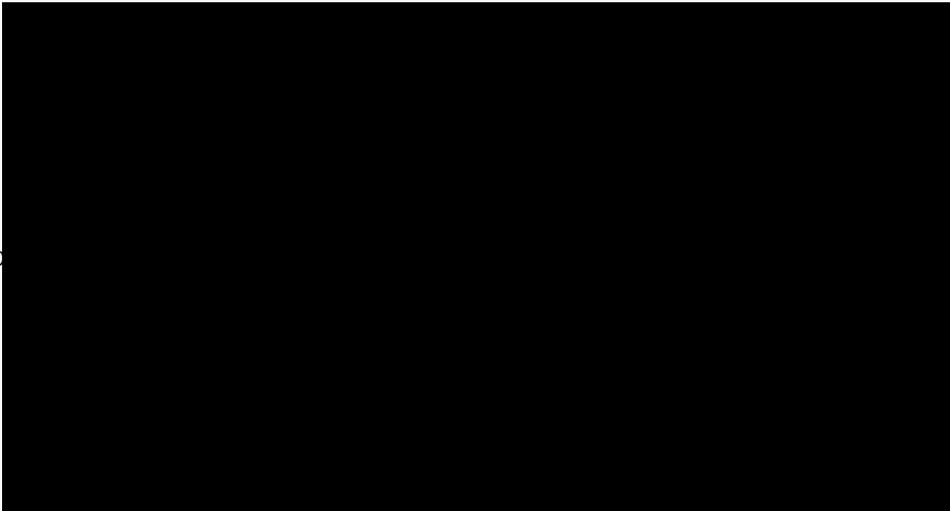
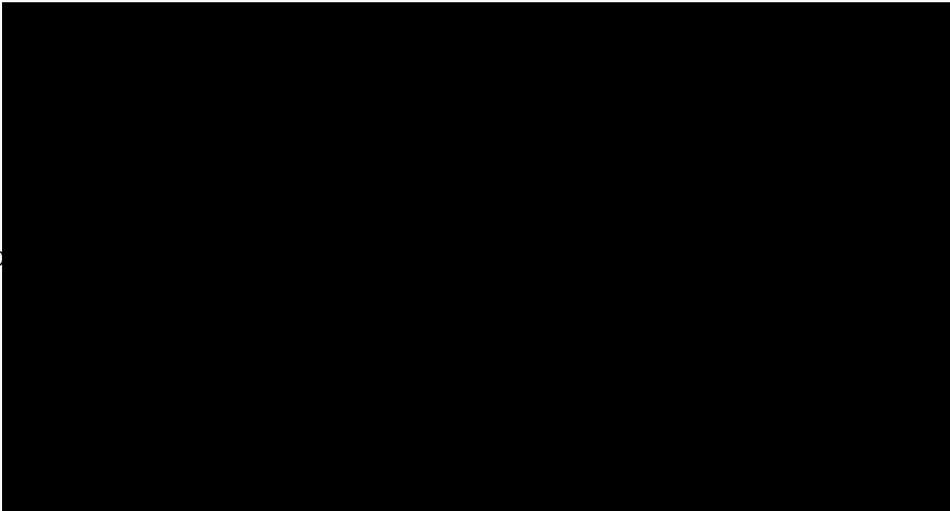
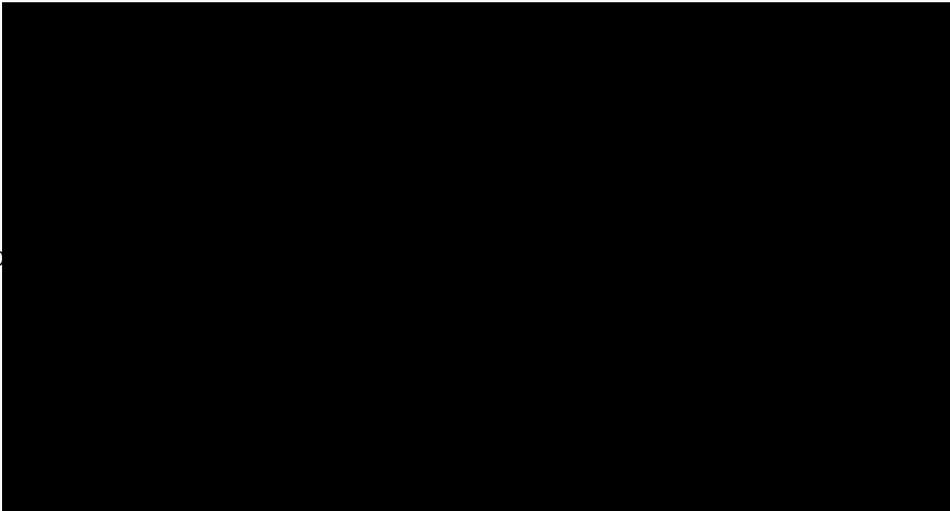
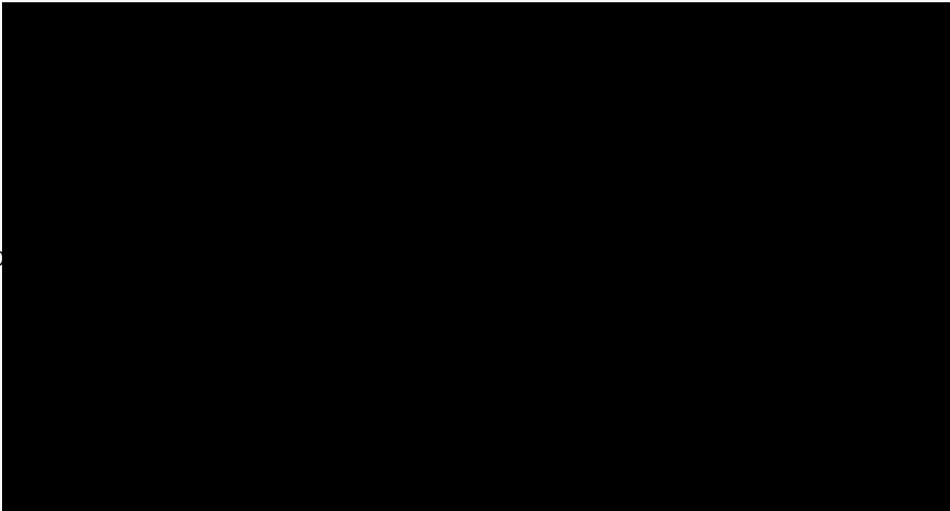
f. Wire lines

10.0 Any Other Information: The parts of this generator are using as spare parts for other generators when this generator stopped working.

DIESEL GENERATOR INSPECTION FORM

G-3 Baghi-e-Pul

1.0 GENERAL

- 1.1 Inspection Date: 17/11/2014
- 1.2 Site Location : Baghi- e -Pul
- 1.3 Site Description (Including total number of Gensets): Baghi-e-Pul diesel power plant is located on Kandahar Herat highway east of Kandahar, there are 8 units diesel generators 2000kVA, 50HZ, 400V, 3phase each.
- 1.4 Investigators :
 - a. 
 - b. 
 - c. 
 - d. 
- 1.5 Po 
 - a. 
 - b. 
 - c. 
 - d. 
- 1.6 Diesel Generator Number: No, 3
- 1.7 GPS Coordinate: 31.614596°, 65.585948°
- 1.8 Genset General Condition: Functional
- 1.9 Genset age(Year of installation): November, 2011

DIESEL GENERATOR INSPECTION FORM
G-3 Baghi-e-Pul

2.0 GENERATORS DATA

- 2.1 Manufacturer: CATERPILLAR
- 2.2 Serial Number: G2W00147
- 2.3 Model Number: SR5
- 2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 16 cylinders generator and feed by the diesel fuel and has 4 turbo systems 2 turbo each side.
- 2.5 Output Power Rating 1600kW, 2000KVA
- 2.6 Operation Condition: Good Fair Not Operational
- 2.7 Condition Notes: The overall generator is good. This generator is functional. The generator runs 5PM to 12AM local time. This generator operated and maintenance by DABS. DABS 70% load this generator.
- 2.8 Operating Hours: 21924
- 2.9 Fuel Usage (Litters/hours): 288Litters/ Hour according to power plant manager
- 2.10 Typical Operation (Hours/day, continues, standby, load etc.): 7 Hours/Day
- 2.11 Maintenance Records: (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.
250 Hours maintenance: Clean the air filter, oil filter and clean the engine.
500 Hours maintenance: Change the air filter, oil filter and engine oil.
18000 Hours maintenance: General Service of the generator, which maintenance team doesn't have enough spear part for the general service.
- 2.12 Present Engine Running Period: 21924 hours
- 2.13 Turbo Charger Installation Possibility: Presently there are four turbo are installed in this generator as depicted in the pictures.

3.0 SITE

- 3.1 GENERAL
- a. Yard Type (flat, sloped, stepped): Flat
- 3.2 DRAINAGE
- a. Type of System (surface or closed): Closed
- 3.3 YARD SURFACING MATERIAL

DIESEL GENERATOR INSPECTION FORM
G-3 Baghi-e-Pul

- a. Material:
 - 3.3.a.1 Type: concrete
 - 3.3.a.2 Size: (44x80)m
- 3.4 SECURITY FENCE
 - a. Height: N/A
 - b. Fabric Material: N/A
 - c. Vehicle Gates (itemize as listed below for each size gate):
 - d. Size: 2.8-4.0 m
 - e. Quantity: 1

DIESEL GENERATOR INSPECTION FORM
G-3 Baghi-e-Pul

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House: This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

Generator House Ventilation System Description: Outdoor

4.2 EXTERNAL DIMENSIONS

a. Length: 12.30 m

b. Width: 2.40 m

c. Clear Height: 3 m

4.3 SUPERSTRUCTURE

a. Type (pre-engineered metal or concrete block): N/A

b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM
G-3 Baghi-e-Pul

5.0 GROUNDING

5.1 GROUND CONNECTIONS

- a. Steel:
 - 5.1.a.1 Type Conductor: N/A
 - 5.1.a.2 Size: N/A
 - 5.1.a.3 Connector: N/A
- b. Equipment:
 - 5.1.b.1 Type Conductor: Copper conductor
 - 5.1.b.2 Size: N/A
 - 5.1.b.3 Connector: Yes
- c. Fence:
 - 5.1.c.1 Type Conductor: N/A
 - 5.1.c.2 Size: N/A
 - 5.1.c.3 Connector: N/A

6.0 RACEWAYS

6.1 Conduit: N/A

- a. Material _____
- b. Size _____ cm (_____ in.)

6.2 Duct Bank: N/A

- a. Size
 - 6.2.a.1 Material: _____
 - 6.2.a.2 Width _____ m (_____ ft)
 - 6.2.a.3 Depth _____ m (_____ ft)
 - 6.2.a.4 Size of conduits _____ cm (_____ in.)

6.3 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete):

Cast-in-place concrete

- 6.3.a.1 Width _____ cm (_____ in.)
- 6.3.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM
G-3 Baghi-e-Pul

7.0 CORROSION

7.1 CATHODIC PROTECTION SYSTEM: N/A

7.2 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8.0 DC SYSTEM

a. Nominal: Voltage 24 volts

b. Battery:

8.1.b.1 Cell type: Wet type battery

8.1.b.2 Number of cells: 2 cells

8.1.b.3 Battery Charger (describe): LaMARCHE A12B Battery charger

8.1.b.4 DC amps: N/A

9.0 CONTROL HOUSE

9.1 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

a. Power line carrier

b. Audio tone

c. Carrier or audio tone on shield wire

d. Microwave (analog, digital, or MAS): Mobile Cell Phone

e. Fiber optics

f. Wire lines

10.0 Any Other Information: Generator getting overheats and requires general services.

DIESEL GENERATOR INSPECTION FORM

G-4 Baghi-e-Pul

1.0 GENERAL

1.1 Inspection Date: 17/11/2014

1.2 Site Location : Baghi- e -Pul

1.3 Site Description (Including total number of Gensets): Baghi-e-Pul diesel power plant is located on Kandahar Herat highway east of Kandahar, there are 8 units diesel generators 2000kVA, 50HZ, 400V, 3phase each.

1.4 Investigators :

a.

b.

c.

d.

1.5 Po

a.

b.

c.

d.

1.6 Die

1.7 GPS Coordinate: 31.614596°, 65.585948°

1.8 Genset General Condition: Nonfunctional

1.9 Genset age(Year of installation): November, 2011

DIESEL GENERATOR INSPECTION FORM
G-4 Baghi-e-Pul

2.0 GENERATORS DATA

- 2.1 Manufacturer: CATERPILLAR
- 2.2 Serial Number: G2W00151
- 2.3 Model Number: SR5
- 2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 16 cylinders generator and feed by the diesel fuel and has 4 turbo systems 2 turbo each side.
- 2.5 Output Power Rating 1600kW, 2000KVA
- 2.6 Operation Condition: Good Fair Not Operational
- 2.7 Condition Notes: This generator is not functional, have engine problem.
- 2.8 Operating Hours: 20756
- 2.9 Fuel Usage (Litters/hours): N/A
- 2.10 Typical Operation (Hours/day, continues, standby, load etc.): N/A
- 2.11 Maintenance Records: (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.
250 Hours maintenance: Clean the air filter, oil filter and clean the engine.
500 Hours maintenance: Change the air filter, oil filter and engine oil.
18000 Hours maintenance: General Service of the generator, which maintenance team doesn't have enough spear part for the general service.
- 2.12 Present Engine Running Period: 20756 hours
- 2.13 Turbo Charger Installation Possibility: Presently there are four turbo are installed in this generator as depicted in the pictures.

3.0 SITE

- 3.1 GENERAL
- a. Yard Type (flat, sloped, stepped): Flat
- 3.2 DRAINAGE
- a. Type of System (surface or closed): Closed
- 3.3 YARD SURFACING MATERIAL
- a. Material:
- 3.3.a.1 Type: concrete
- 3.3.a.2 Size: (44x80)m

DIESEL GENERATOR INSPECTION FORM
G-4 Baghi-e-Pul

3.4 SECURITY FENCE

- a. Height: N/A
- b. Fabric Material: N/A
- c. Vehicle Gates (itemize as listed below for each size gate):
- d. Size: 2.8-4.0 m
- e. Quantity: 1

DIESEL GENERATOR INSPECTION FORM

G-4 Baghi-e-Pul

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House: This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

Generator House Ventilation System Description: Outdoor

4.2 EXTERNAL DIMENSIONS

- a. Length: 12.30 m
- b. Width: 2.40 m
- c. Clear Height: 3 m

4.3 SUPERSTRUCTURE

- a. Type (pre-engineered metal or concrete block): N/A
- b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM
G-4 Baghi-e-Pul

5.0 GROUNDING

5.1 GROUND CONNECTIONS

- a. Steel:
 - 5.1.a.1 Type Conductor: N/A
 - 5.1.a.2 Size: N/A
 - 5.1.a.3 Connector: N/A
- b. Equipment:
 - 5.1.b.1 Type Conductor: Copper conductor
 - 5.1.b.2 Size: N/A
 - 5.1.b.3 Connector: Yes
- c. Fence:
 - 5.1.c.1 Type Conductor: N/A
 - 5.1.c.2 Size: N/A
 - 5.1.c.3 Connector: N/A

6.0 RACEWAYS

6.1 Conduit: N/A

- a. Material _____
- b. Size _____ cm (_____ in.)

6.2 Duct Bank: N/A

- a. Size
 - 6.2.a.1 Material: _____
 - 6.2.a.2 Width _____ m (_____ ft)
 - 6.2.a.3 Depth _____ m (_____ ft)
 - 6.2.a.4 Size of conduits _____ cm (_____ in.)

6.3 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete):

Cast-in-place concrete

- 6.3.a.1 Width _____ cm (_____ in.)
- 6.3.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM
G-4 Baghi-e-Pul

7.0 CORROSION

7.1 CATHODIC PROTECTION SYSTEM: N/A

7.2 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8.0 DC SYSTEM

a. Nominal Voltage 24 volts

b. Battery:

8.1.b.1 Cell type: Wet type battery

8.1.b.2 Number of cells: 2 cells

8.1.b.3 Battery Charger (describe): LaMARCHE A12B Battery charger

8.1.b.4 DC amps: N/A

9.0 CONTROL HOUSE

9.1 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

a. Power line carrier

b. Audio tone

c. Carrier or audio tone on shield wire

d. Microwave (analog, digital, or MAS): Mobile Cell Phone

e. Fiber optics

f. Wire lines

10.0 Any Other Information: The parts of this generator are using as spare parts for other generators when this generator stopped working.

DIESEL GENERATOR INSPECTION FORM

G-5 Baghi-e-Pul

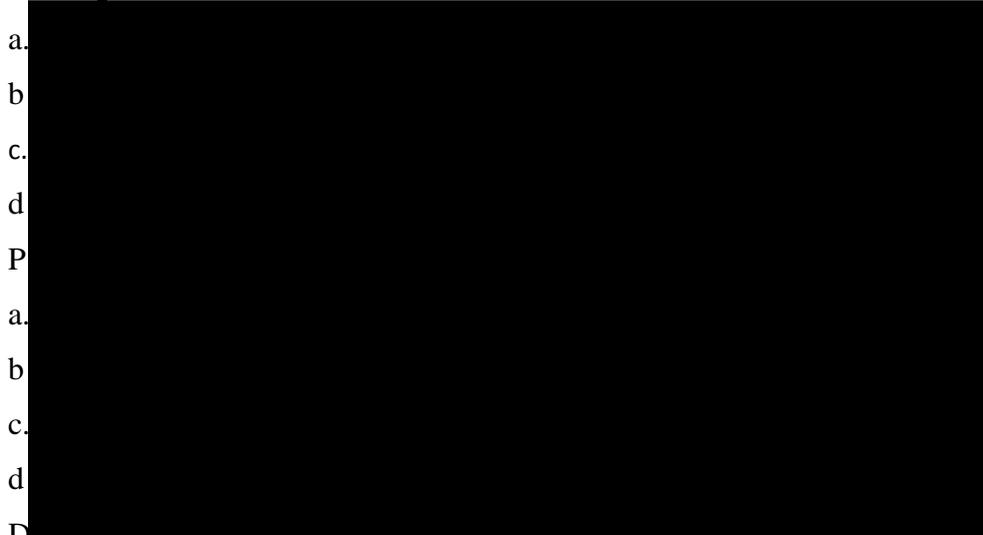
1.0 GENERAL

1.1 Inspection Date: 17/11/2014

1.2 Site Location : Baghi- e -Pul

1.3 Site Description (Including total number of Gensets): Baghi-e-Pul diesel power plant is located on Kandahar Herat highway east of Kandahar, there are 8 units diesel generators 2000kVA, 50HZ, 400V, 3phase each.

1.4 Investigators :



1.5 P

a.
b.
c.
d.

1.6 D

1.7 GPS Coordinate: 31.614596°, 65.585948°

1.8 Genset General Condition: Nonfunctional

1.9 Genset age(Year of installation): November, 2011

DIESEL GENERATOR INSPECTION FORM
G-5 Baghi-e-Pul

2.0 GENERATORS DATA

- 2.1 Manufacturer: CATERPILLAR
- 2.2 Serial Number: G2W00145
- 2.3 Model Number: SR5
- 2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 16 cylinders generator and feed by the diesel fuel and has 4 turbo systems 2 turbo each side.
- 2.5 Output Power Rating 1600kW, 2000KVA
- 2.6 Operation Condition: Good Fair Not Operational
- 2.7 Condition Notes: This generator is not functional, have engine problem.
- 2.8 Operating Hours: 18710
- 2.9 Fuel Usage (Litters/hours): N/A
- 2.10 Typical Operation (Hours/day, continues, standby, load etc.): N/A
- 2.11 Maintenance Records: (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.
250 Hours maintenance: Clean the air filter, oil filter and clean the engine.
500 Hours maintenance: Change the air filter, oil filter and engine oil.
18000 Hours maintenance: General Service of the generator, which maintenance team doesn't have enough spear part for the general service.
- 2.12 Present Engine Running Period: 18710 hours
- 2.13 Turbo Charger Installation Possibility: Presently there are four turbo are installed in this generator as depicted in the pictures.

3.0 SITE

- 3.1 GENERAL
- a. Yard Type (flat, sloped, stepped): Flat
- 3.2 DRAINAGE
- a. Type of System (surface or closed): Closed
- 3.3 YARD SURFACING MATERIAL
- a. Material:
- 3.3.a.1 Type: concrete
- 3.3.a.2 Size: (44x80)m

DIESEL GENERATOR INSPECTION FORM
G-5 Baghi-e-Pul

3.4 SECURITY FENCE

- a. Height: N/A
- b. Fabric Material: N/A
- c. Vehicle Gates (itemize as listed below for each size gate):
- d. Size: 2.8-4.0 m
- e. Quantity: 1

DIESEL GENERATOR INSPECTION FORM

G-5 Baghi-e-Pul

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House: This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

Generator House Ventilation System Description: Outdoor

4.2 EXTERNAL DIMENSIONS

- a. Length: 12.30 m
- b. Width: 2.40 m
- c. Clear Height: 3 m

4.3 SUPERSTRUCTURE

- a. Type (pre-engineered metal or concrete block): N/A
- b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM
G-5 Baghi-e-Pul

5.0 GROUNDING

5.1 GROUND CONNECTIONS

- a. Steel:
 - 5.1.a.1 Type Conductor: N/A
 - 5.1.a.2 Size: N/A
 - 5.1.a.3 Connector: N/A
- b. Equipment:
 - 5.1.b.1 Type Conductor: Copper conductor
 - 5.1.b.2 Size: N/A
 - 5.1.b.3 Connector: Yes
- c. Fence:
 - 5.1.c.1 Type Conductor: N/A
 - 5.1.c.2 Size: N/A
 - 5.1.c.3 Connector: N/A

6.0 RACEWAYS

6.1 Conduit: N/A

- a. Material _____
- b. Size _____ cm (_____ in.)

6.2 Duct Bank: N/A

- a. Size
 - 6.2.a.1 Material: _____
 - 6.2.a.2 Width _____ m (_____ ft)
 - 6.2.a.3 Depth _____ m (_____ ft)
 - 6.2.a.4 Size of conduits _____ cm (_____ in.)

6.3 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete):

Cast-in-place concrete

- 6.3.a.1 Width _____ cm (_____ in.)
- 6.3.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM
G-5 Baghi-e-Pul

7.0 CORROSION

7.1 CATHODIC PROTECTION SYSTEM: N/A

7.2 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8.0 DC SYSTEM

a. Nominal Voltage 24 volts

b. Battery:

8.1.b.1 Cell type: Wet type battery

8.1.b.2 Number of cells: 2 cells

8.1.b.3 Battery Charger (describe): LaMARCHE A12B Battery charger

8.1.b.4 DC amps: N/A

9.0 CONTROL HOUSE

9.1 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

a. Power line carrier

b. Audio tone

c. Carrier or audio tone on shield wire

d. Microwave (analog, digital, or MAS): Mobile Cell Phone

e. Fiber optics

f. Wire lines

10.0 Any Other Information: The parts of this generator are using as spare parts for other generators when this generator stopped working.

DIESEL GENERATOR INSPECTION FORM

G-6 Baghi-e-Pul

1.0 GENERAL

- 1.1 Inspection Date: 17/11/2014
- 1.2 Site Location : Baghi- e -Pul
- 1.3 Site Description (Including total number of Gensets): Baghi-e-Pul diesel power plant is located on Kandahar Herat highway east of Kandahar, there are 8 units diesel generators 2000kVA, 50HZ, 400V, 3phase each.
- 1.4 Investigators :
 - a.
 - b.
 - c.
 - d.
- 1.5 Power
 - a.
 - b.
 - c.
 - d.
- 1.6 Diesel Generator Number: No, 6
- 1.7 GPS Coordinate: 31.614596°, 65.585948°
- 1.8 Genset General Condition: Functional
- 1.9 Genset age(Year of installation): November, 2011

DIESEL GENERATOR INSPECTION FORM
G-6 Baghi-e-Pul

2.0 GENERATORS DATA

- 2.1 Manufacturer: CATERPILLAR
- 2.2 Serial Number: G2W00144
- 2.3 Model Number: SR5
- 2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 16 cylinders generator and feed by the diesel fuel and has 4 turbo systems 2 turbo each side.
- 2.5 Output Power Rating 1600kW, 2000KVA
- 2.6 Operation Condition: Good Fair Not Operational
- 2.7 Condition Notes: The overall generator is good. This generator is functional. The generator runs 5PM to 12AM local time. This generator operated and maintenance by DABS. DABS 70% load this generator.
- 2.8 Operating Hours: 21973
- 2.9 Fuel Usage (Litters/hours): 288Litters/ Hour according to power plant manager
- 2.10 Typical Operation (Hours/day, continues, standby, load etc.): 7 Hours/Day
- 2.11 Maintenance Records: (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.
250 Hours maintenance: Clean the air filter, oil filter and clean the engine.
500 Hours maintenance: Change the air filter, oil filter and engine oil.
18000 Hours maintenance: General Service of the generator, which maintenance team doesn't have enough spear part for the general service.
- 2.12 Present Engine Running Period: 21973 hours
- 2.13 Turbo Charger Installation Possibility: Presently there are four turbo are installed in this generator as depicted in the pictures.

3.0 SITE

- 3.1 GENERAL
- a. Yard Type (flat, sloped, stepped): Flat
- 3.2 DRAINAGE
- a. Type of System (surface or closed): Closed
- 3.3 YARD SURFACING MATERIAL

DIESEL GENERATOR INSPECTION FORM
G-6 Baghi-e-Pul

- a. Material:
 - 3.3.a.1 Type: concrete
 - 3.3.a.2 Size: (44x80)m
- 3.4 SECURITY FENCE
 - a. Height: N/A
 - b. Fabric Material: N/A
 - c. Vehicle Gates (itemize as listed below for each size gate):
 - d. Size: 2.8-4.0 m
 - e. Quantity: 1

DIESEL GENERATOR INSPECTION FORM

G-6 Baghi-e-Pul

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House: This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

Generator House Ventilation System Description: Outdoor

4.2 EXTERNAL DIMENSIONS

- a. Length: 12.30 m
- b. Width: 2.40 m
- c. Clear Height: 3 m

4.3 SUPERSTRUCTURE

- a. Type (pre-engineered metal or concrete block): N/A
- b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM
G-6 Baghi-e-Pul

5.0 GROUNDING

5.1 GROUND CONNECTIONS

- a. Steel:
 - 5.1.a.1 Type Conductor: N/A
 - 5.1.a.2 Size: N/A
 - 5.1.a.3 Connector: N/A
- b. Equipment:
 - 5.1.b.1 Type Conductor: Copper conductor
 - 5.1.b.2 Size: N/A
 - 5.1.b.3 Connector: Yes
- c. Fence:
 - 5.1.c.1 Type Conductor: N/A
 - 5.1.c.2 Size: N/A
 - 5.1.c.3 Connector: N/A

6.0 RACEWAYS

6.1 Conduit: N/A

- a. Material _____
- b. Size _____ cm (_____ in.)

6.2 Duct Bank: N/A

- a. Size
 - 6.2.a.1 Material: _____
 - 6.2.a.2 Width _____ m (_____ ft)
 - 6.2.a.3 Depth _____ m (_____ ft)
 - 6.2.a.4 Size of conduits _____ cm (_____ in.)

6.3 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete):
Cast-in-place concrete
 - 6.3.a.1 Width _____ cm (_____ in.)
 - 6.3.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM
G-6 Baghi-e-Pul

7.0 CORROSION

7.1 CATHODIC PROTECTION SYSTEM: N/A

7.2 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8.0 DC SYSTEM

a. Nominal: Voltage 24 volts

b. Battery:

8.1.b.1 Cell type: Wet type battery

8.1.b.2 Number of cells: 2 cells

8.1.b.3 Battery Charger (describe): LaMARCHE A12B Battery charger

8.1.b.4 DC amps: N/A

9.0 CONTROL HOUSE

9.1 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

a. Power line carrier

b. Audio tone

c. Carrier or audio tone on shield wire

d. Microwave (analog, digital, or MAS): Mobile Cell Phone

e. Fiber optics

f. Wire lines

10.0 Any Other Information: This generator requires general services.

DIESEL GENERATOR INSPECTION FORM

G-7 Baghi-e-Pul

1.0 GENERAL

1.1 Inspection Date: 17/11/2014

1.2 Site Location : Baghi- e -Pul

1.3 Site Description (Including total number of Gensets): Baghi-e-Pul diesel power plant is located on Kandahar Herat highway east of Kandahar, there are 8 units diesel generators 2000kVA, 50HZ, 400V, 3phase each.

1.4 Investigators :

a.

b.

c.

d.

1.5 Po

a.

b.

c.

d.

1.6 Di

1.7 GPS Coordinate: 31.614596°, 65.585948°

1.8 Genset General Condition: Nonfunctional

1.9 Genset age(Year of installation): November, 2011

DIESEL GENERATOR INSPECTION FORM
G-7 Baghi-e-Pul

2.0 GENERATORS DATA

- 2.1 Manufacturer: CATERPILLAR
- 2.2 Serial Number: G2W00148
- 2.3 Model Number: SR5
- 2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 16 cylinders generator and feed by the diesel fuel and has 4 turbo systems 2 turbo each side.
- 2.5 Output Power Rating 1600kW, 2000KVA
- 2.6 Operation Condition: Good Fair Not Operational
- 2.7 Condition Notes: This generator is not functional, have engine problem.
- 2.8 Operating Hours: 17762
- 2.9 Fuel Usage (Litters/hours): N/A
- 2.10 Typical Operation (Hours/day, continues, standby, load etc.): N/A
- 2.11 Maintenance Records: (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.
250 Hours maintenance: Clean the air filter, oil filter and clean the engine.
500 Hours maintenance: Change the air filter, oil filter and engine oil.
18000 Hours maintenance: General Service of the generator, which maintenance team doesn't have enough spear part for the general service.
- 2.12 Present Engine Running Period: 17762 hours
- 2.13 Turbo Charger Installation Possibility: Presently there are four turbo are installed in this generator as depicted in the pictures.

3.0 SITE

- 3.1 GENERAL
 - a. Yard Type (flat, sloped, stepped): Flat
- 3.2 DRAINAGE
 - a. Type of System (surface or closed): Closed
- 3.3 YARD SURFACING MATERIAL
 - a. Material:
 - 3.3.a.1 Type: concrete
 - 3.3.a.2 Size: (44x80)m

DIESEL GENERATOR INSPECTION FORM
G-7 Baghi-e-Pul

3.4 SECURITY FENCE

- a. Height: N/A
- b. Fabric Material: N/A
- c. Vehicle Gates (itemize as listed below for each size gate):
- d. Size: 2.8-4.0 m
- e. Quantity: 1

DIESEL GENERATOR INSPECTION FORM

G-7 Baghi-e-Pul

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House: This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

Generator House Ventilation System Description: Outdoor

4.2 EXTERNAL DIMENSIONS

- a. Length: 12.30 m
- b. Width: 2.40 m
- c. Clear Height: 3 m

4.3 SUPERSTRUCTURE

- a. Type (pre-engineered metal or concrete block): N/A
- b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM
G-7 Baghi-e-Pul

5.0 GROUNDING

5.1 GROUND CONNECTIONS

- a. Steel:
 - 5.1.a.1 Type Conductor: N/A
 - 5.1.a.2 Size: N/A
 - 5.1.a.3 Connector: N/A
- b. Equipment:
 - 5.1.b.1 Type Conductor: Copper conductor
 - 5.1.b.2 Size: N/A
 - 5.1.b.3 Connector: Yes
- c. Fence:
 - 5.1.c.1 Type Conductor: N/A
 - 5.1.c.2 Size: N/A
 - 5.1.c.3 Connector: N/A

6.0 RACEWAYS

6.1 Conduit: N/A

- a. Material _____
- b. Size _____ cm (_____ in.)

6.2 Duct Bank: N/A

- a. Size
 - 6.2.a.1 Material: _____
 - 6.2.a.2 Width _____ m (_____ ft)
 - 6.2.a.3 Depth _____ m (_____ ft)
 - 6.2.a.4 Size of conduits _____ cm (_____ in.)

6.3 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete):

Cast-in-place concrete

- 6.3.a.1 Width _____ cm (_____ in.)
- 6.3.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM
G-7 Baghi-e-Pul

7.0 CORROSION

7.1 CATHODIC PROTECTION SYSTEM: N/A

7.2 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8.0 DC SYSTEM

a. Nominal Voltage: 24 volts

b. Battery:

8.1.b.1 Cell type: Wet type battery

8.1.b.2 Number of cells: 2 cells

8.1.b.3 Battery Charger (describe): LaMARCHE A12B Battery charger

8.1.b.4 DC amps: N/A

9.0 CONTROL HOUSE

9.1 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

a. Power line carrier

b. Audio tone

c. Carrier or audio tone on shield wire

d. Microwave (analog, digital, or MAS): Mobile Cell Phone

e. Fiber optics

f. Wire lines

10.0 Any Other Information: The parts of this generator are using as spare parts for other generators when this generator stopped working.

DIESEL GENERATOR INSPECTION FORM

G-8 Baghi-e-Pul

1.0 GENERAL

- 1.1 Inspection Date: 17/11/2014
- 1.2 Site Location : Baghi- e -Pul
- 1.3 Site Description (Including total number of Gensets): Baghi-e-Pul diesel power plant is located on Kandahar Herat highway east of Kandahar, there are 8 units diesel generators 2000kVA, 50HZ, 400V, 3phase each.
- 1.4 Investigators :
 - a.
 - b.
 - c.
 - d.
- 1.5 Power
 - a.
 - b.
 - c.
 - d.
- 1.6 Diesel Generator Number: No, 8
- 1.7 GPS Coordinate: 31.614596°, 65.585948°
- 1.8 Genset General Condition: Functional
- 1.9 Genset age(Year of installation): November, 2011

DIESEL GENERATOR INSPECTION FORM

G-8 Baghi-e-Pul

2.0 GENERATORS DATA

- 2.1 Manufacturer: CATERPILLAR
- 2.2 Serial Number: G2W00150
- 2.3 Model Number: SR5
- 2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 16 cylinders generator and feed by the diesel fuel and has 4 turbo systems 2 turbo each side.
- 2.5 Output Power Rating 1600kW, 2000KVA
- 2.6 Operation Condition: Good Fair Not Operational
- 2.7 Condition Notes: The overall generator is good but having oil leakage. This generator is functional. The generator runs 5PM to 12AM local time. This generator operated and maintenance by DABS. DABS 70% load this generator.
- 2.8 Operating Hours: 21776
- 2.9 Fuel Usage (Litters/hours): 288Litters/ Hour according to power plant manager
- 2.10 Typical Operation (Hours/day, continues, standby, load etc.): 7 Hours/Day
- 2.11 Maintenance Records: (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.
250 Hours maintenance: Clean the air filter, oil filter and clean the engine.
500 Hours maintenance: Change the air filter, oil filter and engine oil.
18000 Hours maintenance: General Service of the generator, which maintenance team doesn't have enough spear part for the general service.
- 2.12 Present Engine Running Period: 21776 hours
- 2.13 Turbo Charger Installation Possibility: Presently there are four turbo are installed in this generator as depicted in the pictures.

3.0 SITE

- 3.1 GENERAL
 - a. Yard Type (flat, sloped, stepped): Flat
- 3.2 DRAINAGE
 - a. Type of System (surface or closed): Closed

DIESEL GENERATOR INSPECTION FORM
G-8 Baghi-e-Pul

3.3 YARD SURFACING MATERIAL

a. Material:

3.3.a.1 Type: concrete

3.3.a.2 Size: (44x80)m

3.4 SECURITY FENCE

a. Height: N/A

b. Fabric Material: N/A

c. Vehicle Gates (itemize as listed below for each size gate):

d. Size: 2.8-4.0 m

e. Quantity: 1

DIESEL GENERATOR INSPECTION FORM

G-8 Baghi-e-Pul

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House: This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

Generator House Ventilation System Description: Outdoor

4.2 EXTERNAL DIMENSIONS

- a. Length: 12.30 m
- b. Width: 2.40 m
- c. Clear Height: 3 m

4.3 SUPERSTRUCTURE

- a. Type (pre-engineered metal or concrete block): N/A
- b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM
G-8 Baghi-e-Pul

5.0 GROUNDING

5.1 GROUND CONNECTIONS

- a. Steel:
 - 5.1.a.1 Type Conductor: N/A
 - 5.1.a.2 Size: N/A
 - 5.1.a.3 Connector: N/A
- b. Equipment:
 - 5.1.b.1 Type Conductor: Copper conductor
 - 5.1.b.2 Size: N/A
 - 5.1.b.3 Connector: Yes
- c. Fence:
 - 5.1.c.1 Type Conductor: N/A
 - 5.1.c.2 Size: N/A
 - 5.1.c.3 Connector: N/A

6.0 RACEWAYS

6.1 Conduit: N/A

- a. Material _____
- b. Size _____ cm (_____ in.)

6.2 Duct Bank: N/A

- a. Size
 - 6.2.a.1 Material: _____
 - 6.2.a.2 Width _____ m (_____ ft)
 - 6.2.a.3 Depth _____ m (_____ ft)
 - 6.2.a.4 Size of conduits _____ cm (_____ in.)

6.3 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete):

Cast-in-place concrete

- 6.3.a.1 Width _____ cm (_____ in.)
- 6.3.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM
G-8 Baghi-e-Pul

7.0 CORROSION

7.1 CATHODIC PROTECTION SYSTEM: N/A

7.2 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8.0 DC SYSTEM

a. Nominal Voltage: 24 volts

b. Battery:

8.1.b.1 Cell type: Wet type battery

8.1.b.2 Number of cells: 2 cells

8.1.b.3 Battery Charger (describe): LaMARCHE A12B Battery charger

8.1.b.4 DC amps: N/A

9.0 CONTROL HOUSE

9.1 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

a. Power line carrier

b. Audio tone

c. Carrier or audio tone on shield wire

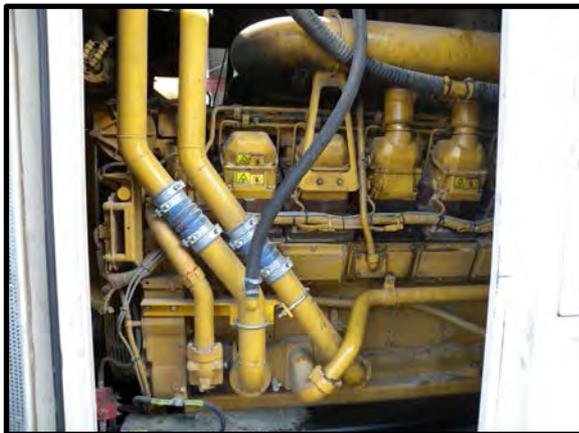
d. Microwave (analog, digital, or MAS): Mobile Cell Phone

e. Fiber optics

f. Wire lines

10.0 Any Other Information: This generator having oil leakage and requires general services.

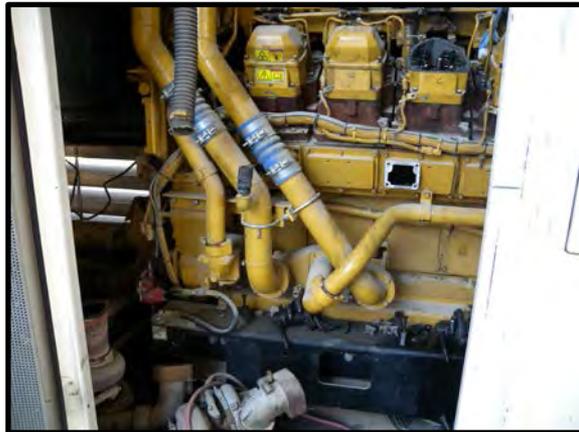
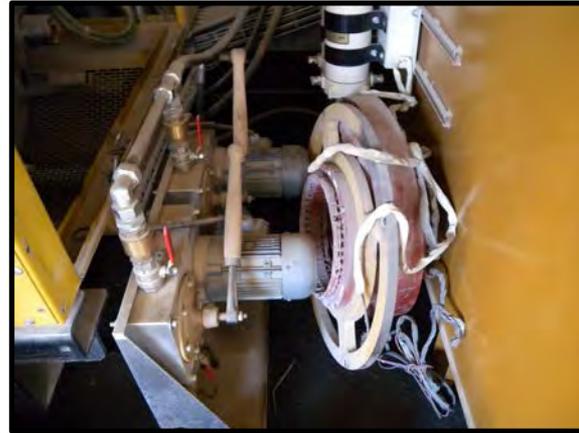
Generator 1 Baghi-e-Pul



Generator 1 Baghi-e-Pul



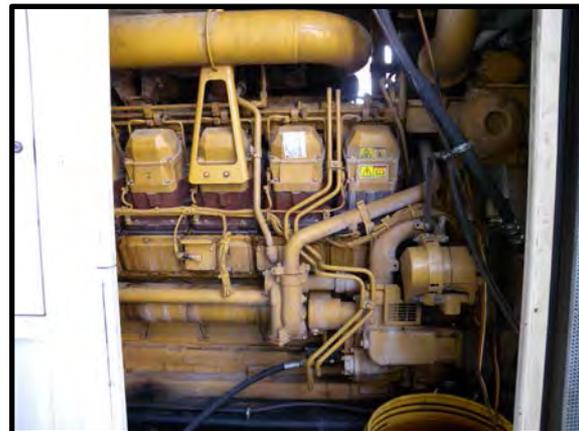
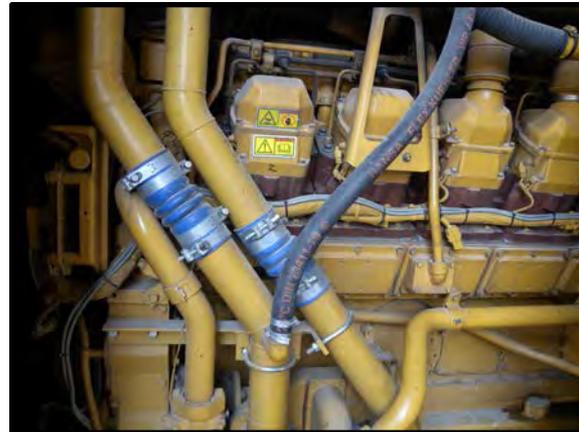
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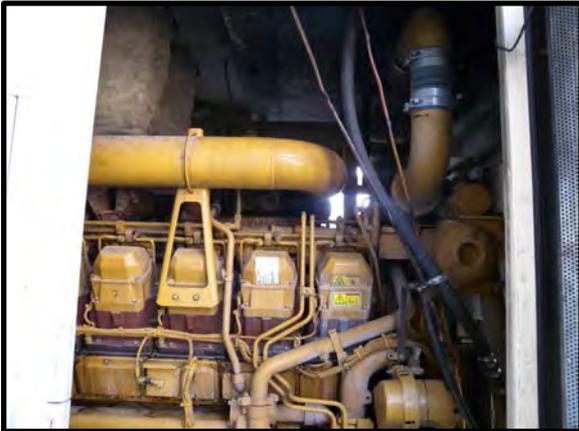
Generator 2 Baghi-e-Pul



Generator 3 Baghi-e-Pul



Generator 3 Baghi-e-Pul



Generator 4 Baghi-e-Pul



Generator 4 Baghi-e-Pul



Generator 5 Baghi-e-Pul



Generator 5 Baghi-e-Pul



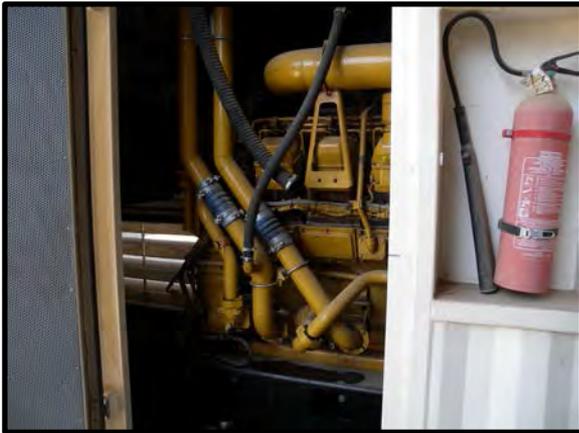
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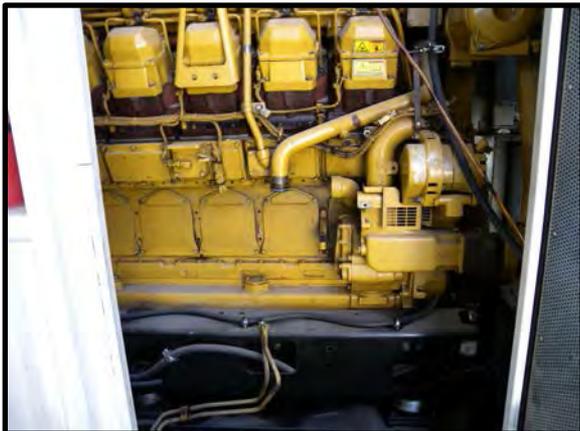
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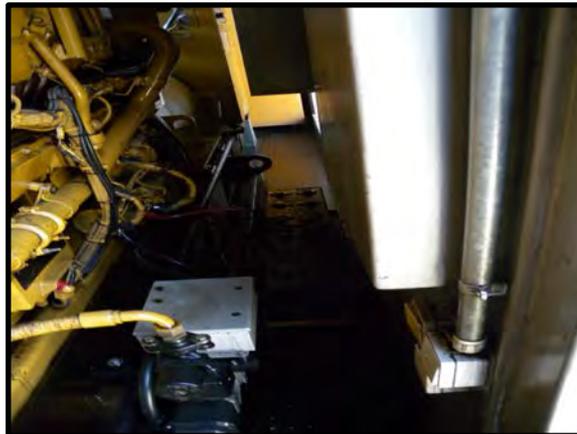
Generator 7 Baghi-e-Pul



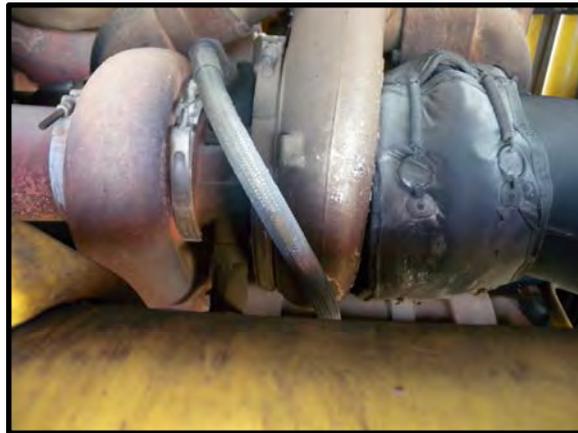
Generator 7 Baghi-e-Pul



Generator 8 Baghi-e-Pul



Generator 8 Baghi-e-Pul



APPENDIX C.2
FIELD SURVEY RESULTS AT BRESHNA KOT

DIESEL GENERATOR INSPECTION FORM

G-1 Breshna Kot

1.0 GENERAL

1.1 Inspection Date: 18/11/2014

1.2 Site Location : Breshna Kot

1.3 Site Description (Including total number of Gensets): Breshna Kot diesel power plant is located on center of Kandahar city, there are 7 units' diesel generators 1906kVA, 50HZ, 400V, 3phase each.

1.4 Investigators :

a.

b.

c.

d.

1.5 Pow

a.

b.

c.

1.6 Die

1.7 GPS Coordinate: 31.629534°, 65.708998°

1.8 Genset General Condition: Functional

1.9 Genset age(Year of installation): December, 2012

DIESEL GENERATOR INSPECTION FORM

G-1 Breshna Kot

2.0 GENERATORS DATA

- 2.1 Manufacturer: mtu
- 2.2 Serial Number: 335726-1-13-0911
- 2.3 Model Number: 1800FXC5D(G63)
- 2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 16 cylinders generator and feed by the diesel fuel and has 4 turbo systems 2 turbo each side.
- 2.5 Output Power Rating 1525kW, 1906KVA
- 2.6 Operation Condition: Good Fair Not Operational
- 2.7 Condition Notes: The overall generator is good. This generator is functional. The generator runs when the Kajaki power is off. This generator operated and maintenance by DABS. DABS 80% load this generator.
- 2.8 Operating Hours: 3252
- 2.9 Fuel Usage (Litters/hours): 280Litters/ Hour according to power plant manager
- 2.10 Typical Operation (Hours/day, continues, standby, load etc.): When the Kajaki power is off.
- 2.11 Maintenance Records: (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.
250 Hours maintenance: Clean the air filter, oil filter and clean the engine.
500 Hours maintenance: Change the air filter, oil filter and engine oil.
18000 Hours maintenance: General Service of the generator, which maintenance team doesn't have enough spear part for the general service.
- 2.12 Present Engine Running Period: 3252 hours
- 2.13 Turbo Charger Installation Possibility: Presently there are four turbo are installed in this generator as depicted in the pictures.

3.0 SITE

- 3.1 GENERAL
- a. Yard Type (flat, sloped, stepped): Flat
- 3.2 DRAINAGE
- a. Type of System (surface or closed): Closed

DIESEL GENERATOR INSPECTION FORM
G-1 Breshna Kot

3.3 YARD SURFACING MATERIAL

a. Material:

3.3.a.1 Type: Concrete

3.3.a.2 Size: 2(4.45x1.2)m

3.4 SECURITY FENCE

a. Height: N/A

b. Fabric Material: N/A

c. Vehicle Gates (itemize as listed below for each size gate):

d. Size: 2.8-4.0 m

e. Quantity: 1

DIESEL GENERATOR INSPECTION FORM

G-1 Breshna Kot

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House: This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

Generator House Ventilation System Description: Outdoor

4.2 EXTERNAL DIMENSIONS

- a. Length: 12.30 m
- b. Width: 2.40 m
- c. Clear Height: 3 m

4.3 SUPERSTRUCTURE

- a. Type (pre-engineered metal or concrete block): N/A
- b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM
G-1 Breshna Kot

5.0 GROUNDING

5.1 GROUND CONNECTIONS

- a. Steel:
 - 5.1.a.1 Type Conductor: N/A
 - 5.1.a.2 Size: N/A
 - 5.1.a.3 Connector: N/A
- b. Equipment:
 - 5.1.b.1 Type Conductor: Copper conductor
 - 5.1.b.2 Size: N/A
 - 5.1.b.3 Connector: Yes
- c. Fence:
 - 5.1.c.1 Type Conductor: N/A
 - 5.1.c.2 Size: N/A
 - 5.1.c.3 Connector: N/A

6.0 RACEWAYS

6.1 Conduit: N/A

- a. Material _____
- b. Size _____ cm (_____ in.)

6.2 Duct Bank: N/A

- a. Size
 - 6.2.a.1 Material: _____
 - 6.2.a.2 Width _____ m (_____ ft)
 - 6.2.a.3 Depth _____ m (_____ ft)
 - 6.2.a.4 Size of conduits _____ cm (_____ in.)

6.3 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete):

Cast-in-place concrete

- 6.3.a.1 Width _____ cm (_____ in.)
- 6.3.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM
G-1 Breshna Kot

7.0 CORROSION

7.1 CATHODIC PROTECTION SYSTEM: N/A

7.2 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8.0 DC SYSTEM

a. Nominal Voltage: 24 volts

b. Battery:

8.1.b.1 Cell type: Wet type battery

8.1.b.2 Number of cells: 2 cells

8.1.b.3 Battery Charger (describe): N/A

8.1.b.4 DC amps: N/A

9.0 CONTROL HOUSE

9.1 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

a. Power line carrier

b. Audio tone

c. Carrier or audio tone on shield wire

d. Microwave (analog, digital, or MAS): Mobile Cell Phone

e. Fiber optics

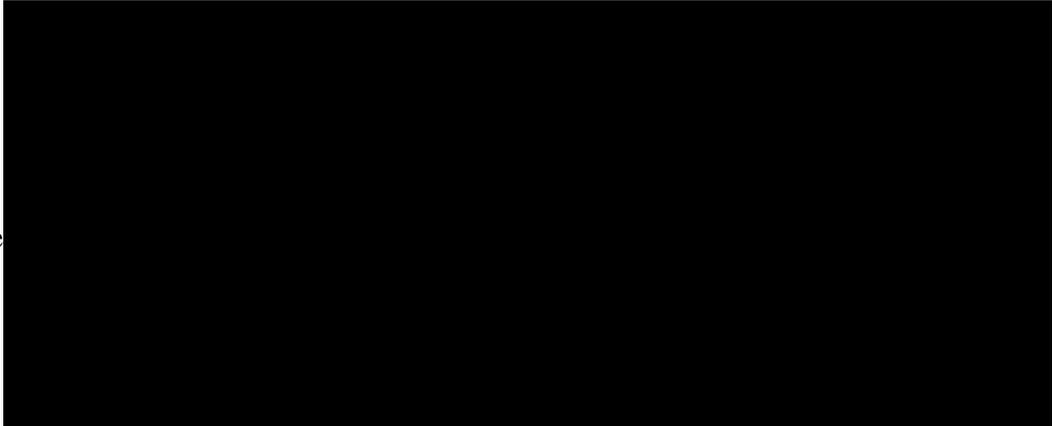
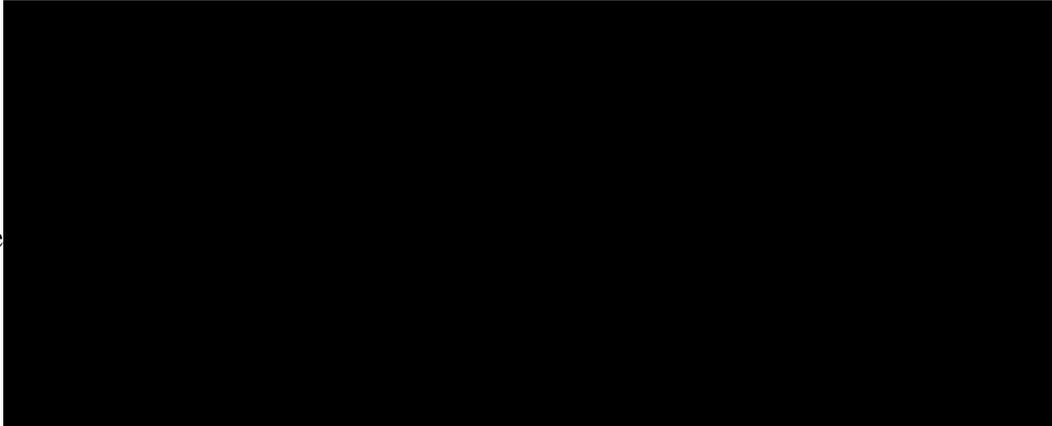
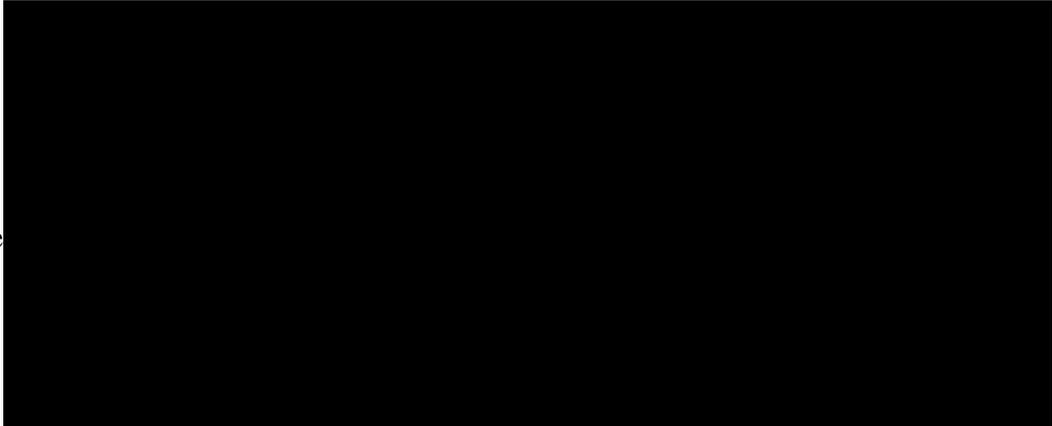
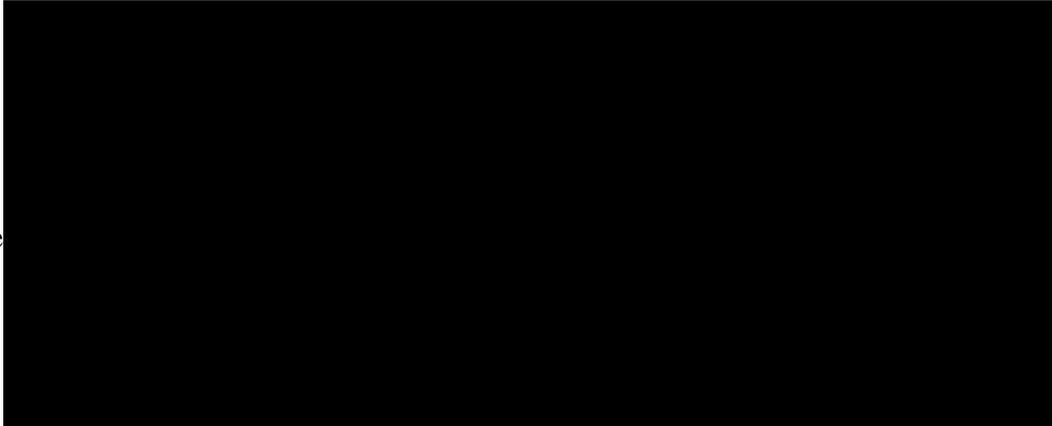
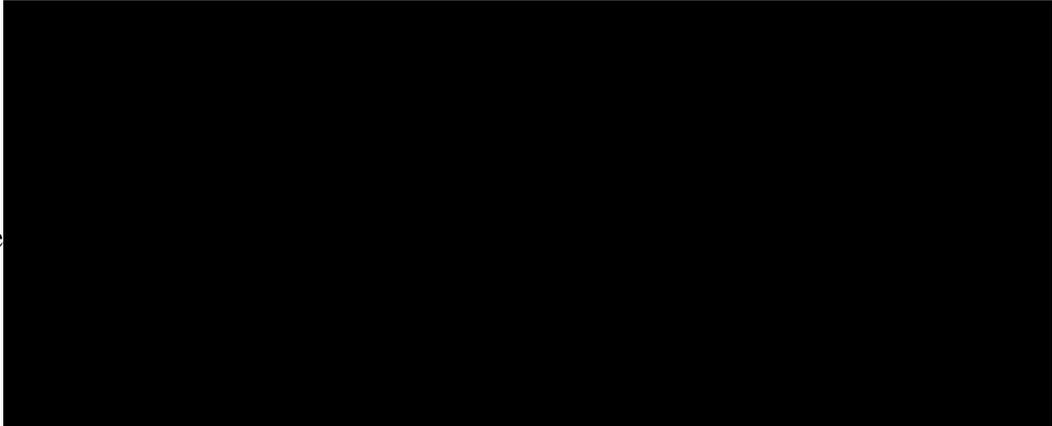
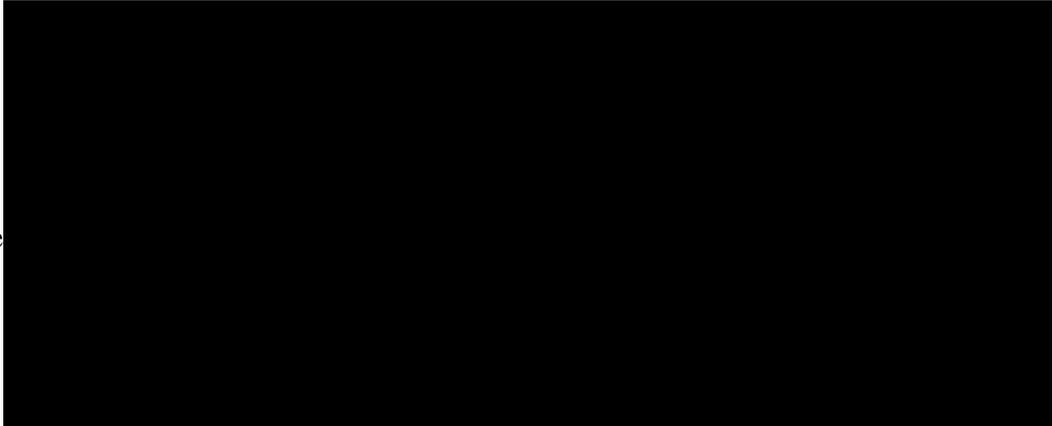
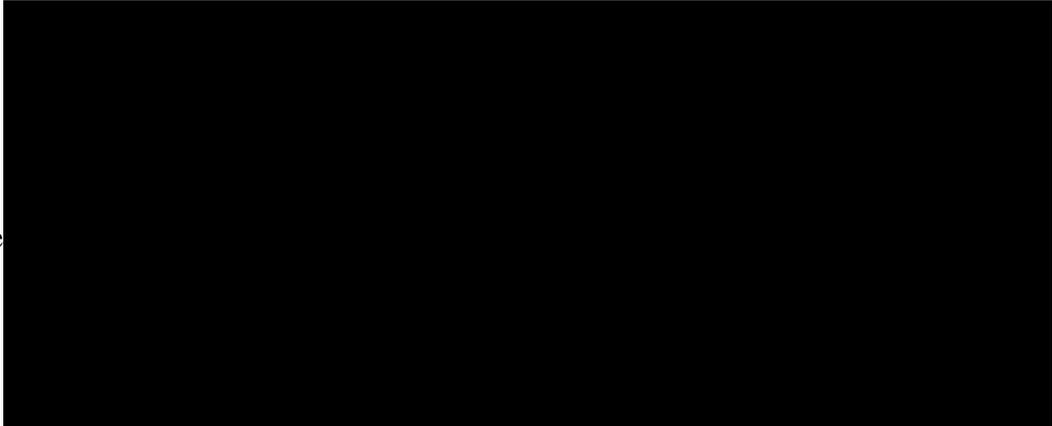
f. Wire lines

10.0 Any Other Information: Nil

DIESEL GENERATOR INSPECTION FORM

G-2 Breshna Kot

1.0 GENERAL

- 1.1 Inspection Date: 18/11/2014
- 1.2 Site Location : Breshna Kot
- 1.3 Site Description (Including total number of Gensets): Breshna Kot diesel power plant is located on center of Kandahar city, there are 7 units diesel generators 1906kVA, 50HZ, 400V, 3phase each.
- 1.4 Investigators :
 - a. 
 - b. 
 - c. 
 - d. 
- 1.5 Powe
 - a. 
 - b. 
 - c. 
- 1.6 Diesel Generator Number: No, 2
- 1.7 GPS Coordinate: 31.629534°, 65.708998°
- 1.8 Genset General Condition: Functional
- 1.9 Genset age(Year of installation): December, 2012

DIESEL GENERATOR INSPECTION FORM

G-2 Breshna Kot

2.0 GENERATORS DATA

- 2.1 Manufacturer: mtu
- 2.2 Serial Number: 335726-1-6-0911
- 2.3 Model Number: 1800FXC5D(G63)
- 2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 16 cylinders generator and feed by the diesel fuel and has 4 turbo systems 2 turbo each side.
- 2.5 Output Power Rating 1525kW, 1906KVA
- 2.6 Operation Condition: Good Fair Not Operational
- 2.7 Condition Notes: The overall generator is good. This generator is functional. The generator runs when the Kajaki power is off. This generator operated and maintenance by DABS. DABS 80% load this generator.
- 2.8 Operating Hours: 3929
- 2.9 Fuel Usage (Litters/hours): 280Litters/ Hour according to power plant manager
- 2.10 Typical Operation (Hours/day, continues, standby, load etc.): When the Kajaki power is off.
- 2.11 Maintenance Records: (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.
250 Hours maintenance: Clean the air filter, oil filter and clean the engine.
500 Hours maintenance: Change the air filter, oil filter and engine oil.
18000 Hours maintenance: General Service of the generator, which maintenance team doesn't have enough spear part for the general service.
- 2.12 Present Engine Running Period: 3929 hours
- 2.13 Turbo Charger Installation Possibility: Presently there are four turbo are installed in this generator as depicted in the pictures.

3.0 SITE

- 3.1 GENERAL
- a. Yard Type (flat, sloped, stepped): Flat
- 3.2 DRAINAGE
- a. Type of System (surface or closed): Closed

DIESEL GENERATOR INSPECTION FORM
G-2 Breshna Kot

3.3 YARD SURFACING MATERIAL

a. Material:

3.3.a.1 Type: Concrete

3.3.a.2 Size: 2(4.45x1.2)m

3.4 SECURITY FENCE

a. Height: N/A

b. Fabric Material: N/A

c. Vehicle Gates (itemize as listed below for each size gate):

d. Size: 2.8-4.0 m

e. Quantity: 1

DIESEL GENERATOR INSPECTION FORM

G-2 Breshna Kot

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House: This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

Generator House Ventilation System Description: Outdoor

4.2 EXTERNAL DIMENSIONS

- a. Length: 12.30 m
- b. Width: 2.40 m
- c. Clear Height: 3 m

4.3 SUPERSTRUCTURE

- a. Type (pre-engineered metal or concrete block): N/A
- b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM
G-2 Breshna Kot

5.0 GROUNDING

5.1 GROUND CONNECTIONS

- a. Steel:
 - 5.1.a.1 Type Conductor: N/A
 - 5.1.a.2 Size: N/A
 - 5.1.a.3 Connector: N/A
- b. Equipment:
 - 5.1.b.1 Type Conductor: Copper conductor
 - 5.1.b.2 Size: N/A
 - 5.1.b.3 Connector: Yes
- c. Fence:
 - 5.1.c.1 Type Conductor: N/A
 - 5.1.c.2 Size: N/A
 - 5.1.c.3 Connector: N/A

6.0 RACEWAYS

6.1 Conduit: N/A

- a. Material _____
- b. Size _____ cm (_____ in.)

6.2 Duct Bank: N/A

- a. Size
 - 6.2.a.1 Material: _____
 - 6.2.a.2 Width _____ m (_____ ft)
 - 6.2.a.3 Depth _____ m (_____ ft)
 - 6.2.a.4 Size of conduits _____ cm (_____ in.)

6.3 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete):
Cast-in-place concrete
 - 6.3.a.1 Width _____ cm (_____ in.)
 - 6.3.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM
G-2 Breshna Kot

7.0 CORROSION

7.1 CATHODIC PROTECTION SYSTEM: N/A

7.2 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8.0 DC SYSTEM

a. Nominal Voltage: 24 volts

b. Battery:

8.1.b.1 Cell type: Wet type battery

8.1.b.2 Number of cells: 2 cells

8.1.b.3 Battery Charger (describe): N/A

8.1.b.4 DC amps: N/A

9.0 CONTROL HOUSE

9.1 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

a. Power line carrier

b. Audio tone

c. Carrier or audio tone on shield wire

d. Microwave (analog, digital, or MAS): Mobile Cell Phone

e. Fiber optics

f. Wire lines

10.0 Any Other Information: Nil

DIESEL GENERATOR INSPECTION FORM
G-3 Breshna Kot

1.0 GENERAL

1.1 Inspection Date: 18/11/2014

1.2 Site Location : Breshna Kot

1.3 Site Description (Including total number of Gensets): Breshna Kot diesel power plant is located on center of Kandahar city, there are 7 units diesel generators 1906kVA, 50HZ, 400V, 3phase each.

1.4 Investigators :

a.

b.

c.

d.

1.5 Power

a.

b.

c.

1.6 Diesel Generator Number: No, 3

1.7 GPS Coordinate: 31.629534°, 65.708998°

1.8 Genset General Condition: Functional

1.9 Genset age(Year of installation): December, 2012

DIESEL GENERATOR INSPECTION FORM
G-3 Breshna Kot

2.0 GENERATORS DATA

- 2.1 Manufacturer: mtu
- 2.2 Serial Number: 335726-1-5-0911
- 2.3 Model Number: 1800FXC5D(G63)
- 2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 16 cylinders generator and feed by the diesel fuel and has 4 turbo systems 2 turbo each side.
- 2.5 Output Power Rating 1525kW, 1906KVA
- 2.6 Operation Condition: Good Fair Not Operational
- 2.7 Condition Notes: The overall generator is good. This generator is functional. The generator runs when the Kajaki power is off. This generator operated and maintenance by DABS. DABS 80% load this generator.
- 2.8 Operating Hours: 3307
- 2.9 Fuel Usage (Litters/hours): 280Litters/ Hour according to power plant manager
- 2.10 Typical Operation (Hours/day, continues, standby, load etc.): When the Kajaki power is off.
- 2.11 Maintenance Records: (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.
250 Hours maintenance: Clean the air filter, oil filter and clean the engine.
500 Hours maintenance: Change the air filter, oil filter and engine oil.
18000 Hours maintenance: General Service of the generator, which maintenance team doesn't have enough spear part for the general service.
- 2.12 Present Engine Running Period: 3307 hours
- 2.13 Turbo Charger Installation Possibility: presently there are four turbo are installed in this generator as depicted in the pictures.

3.0 SITE

- 3.1 GENERAL
- a. Yard Type (flat, sloped, stepped): Flat
- 3.2 DRAINAGE
- a. Type of System (surface or closed): Closed

DIESEL GENERATOR INSPECTION FORM
G-3 Breshna Kot

3.3 YARD SURFACING MATERIAL

a. Material:

3.3.a.1 Type: Concrete

3.3.a.2 Size: 2(4.45x1.2)m

3.4 SECURITY FENCE

a. Height: N/A

b. Fabric Material: N/A

c. Vehicle Gates (itemize as listed below for each size gate):

d. Size: 2.8-4.0 m

e. Quantity: 1

DIESEL GENERATOR INSPECTION FORM

G-3 Breshna Kot

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House: This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

Generator House Ventilation System Description: Outdoor

4.2 EXTERNAL DIMENSIONS

- a. Length: 12.30 m
- b. Width: 2.40 m
- c. Clear Height: 3 m

4.3 SUPERSTRUCTURE

- a. Type (pre-engineered metal or concrete block): N/A
- b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM
G-3 Breshna Kot

5.0 GROUNDING

5.1 GROUND CONNECTIONS

- a. Steel:
 - 5.1.a.1 Type Conductor: N/A
 - 5.1.a.2 Size: N/A
 - 5.1.a.3 Connector: N/A
- b. Equipment:
 - 5.1.b.1 Type Conductor: Copper conductor
 - 5.1.b.2 Size: N/A
 - 5.1.b.3 Connector: Yes
- c. Fence:
 - 5.1.c.1 Type Conductor: N/A
 - 5.1.c.2 Size: N/A
 - 5.1.c.3 Connector: N/A

6.0 RACEWAYS

6.1 Conduit: N/A

- a. Material _____
- b. Size _____ cm (_____ in.)

6.2 Duct Bank: N/A

- a. Size
 - 6.2.a.1 Material: _____
 - 6.2.a.2 Width _____ m (_____ ft)
 - 6.2.a.3 Depth _____ m (_____ ft)
 - 6.2.a.4 Size of conduits _____ cm (_____ in.)

6.3 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete):

Cast-in-place concrete

- 6.3.a.1 Width _____ cm (_____ in.)
- 6.3.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM
G-3 Breshna Kot

7.0 CORROSION

7.1 CATHODIC PROTECTION SYSTEM: N/A

7.2 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8.0 DC SYSTEM

a. Nominal Voltage: 24 volts

b. Battery:

8.1.b.1 Cell type: Wet type battery

8.1.b.2 Number of cells: 2 cells

8.1.b.3 Battery Charger (describe): N/A

8.1.b.4 DC amps: N/A

9.0 CONTROL HOUSE

9.1 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

a. Power line carrier

b. Audio tone

c. Carrier or audio tone on shield wire

d. Microwave (analog, digital, or MAS): Mobile Cell Phone

e. Fiber optics

f. Wire lines

10.0 Any Other Information: Nil

DIESEL GENERATOR INSPECTION FORM
G-4 Breshna Kot

1.0 GENERAL

1.1 Inspection Date: 18/11/2014

1.2 Site Location : Breshna Kot

1.3 Site Description (Including total number of Gensets): Breshna Kot diesel power plant is located on center of Kandahar city, there are 7 units diesel generators 1906kVA, 50HZ, 400V, 3phase each.

1.4 Investigators :

a.

b.

c.

d.

1.5 P

a.

b.

c.

1.6 D

1.7 GPS Coordinate: 31.629534°, 65.708998°

1.8 Genset General Condition: Functional

1.9 Genset age(Year of installation): December, 2012

DIESEL GENERATOR INSPECTION FORM
G-4 Breshna Kot

2.0 GENERATORS DATA

- 2.1 Manufacturer: mtu
- 2.2 Serial Number: 335726-1-4-0911
- 2.3 Model Number: 1800FXC5D(G63)
- 2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 16 cylinders generator and feed by the diesel fuel and has 4 turbo systems 2 turbo each side.
- 2.5 Output Power Rating 1525kW, 1906KVA
- 2.6 Operation Condition: Good Fair Not Operational
- 2.7 Condition Notes: The overall generator is good. This generator is functional. The generator runs when the Kajaki power is off. This generator operated and maintenance by DABS. DABS 80% load this generator.
- 2.8 Operating Hours: 3907
- 2.9 Fuel Usage (Litters/hours): 280Litters/ Hour according to power plant manager
- 2.10 Typical Operation (Hours/day, continues, standby, load etc.): When the Kajaki power is off.
- 2.11 Maintenance Records: (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.
250 Hours maintenance: Clean the air filter, oil filter and clean the engine.
500 Hours maintenance: Change the air filter, oil filter and engine oil.
18000 Hours maintenance: General Service of the generator, which maintenance team doesn't have enough spear part for the general service.
- 2.12 Present Engine Running Period: 3907 hours
- 2.13 Turbo Charger Installation Possibility: presently there are four turbo are installed in this generator as depicted in the pictures.

3.0 SITE

- 3.1 GENERAL
- a. Yard Type (flat, sloped, stepped): Flat
- 3.2 DRAINAGE
- a. Type of System (surface or closed): Closed

DIESEL GENERATOR INSPECTION FORM
G-4 Breshna Kot

3.3 YARD SURFACING MATERIAL

a. Material:

3.3.a.1 Type: Concrete

3.3.a.2 Size: 2(4.45x1.2)m

3.4 SECURITY FENCE

a. Height: N/A

b. Fabric Material: N/A

c. Vehicle Gates (itemize as listed below for each size gate):

d. Size: 2.8-4.0 m

e. Quantity: 1

DIESEL GENERATOR INSPECTION FORM
G-4 Breshna Kot

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House: This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

Generator House Ventilation System Description: Outdoor

4.2 EXTERNAL DIMENSIONS

- a. Length: 12.30 m
- b. Width: 2.40 m
- c. Clear Height: 3 m

4.3 SUPERSTRUCTURE

- a. Type (pre-engineered metal or concrete block): N/A
- b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM
G-4 Breshna Kot

5.0 GROUNDING

5.1 GROUND CONNECTIONS

- a. Steel:
 - 5.1.a.1 Type Conductor: N/A
 - 5.1.a.2 Size: N/A
 - 5.1.a.3 Connector: N/A
- b. Equipment:
 - 5.1.b.1 Type Conductor: Copper conductor
 - 5.1.b.2 Size: N/A
 - 5.1.b.3 Connector: Yes
- c. Fence:
 - 5.1.c.1 Type Conductor: N/A
 - 5.1.c.2 Size: N/A
 - 5.1.c.3 Connector: N/A

6.0 RACEWAYS

6.1 Conduit: N/A

- a. Material _____
- b. Size _____ cm (_____ in.)

6.2 Duct Bank: N/A

- a. Size
 - 6.2.a.1 Material: _____
 - 6.2.a.2 Width _____ m (_____ ft)
 - 6.2.a.3 Depth _____ m (_____ ft)
 - 6.2.a.4 Size of conduits _____ cm (_____ in.)

6.3 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete):

Cast-in-place concrete

- 6.3.a.1 Width _____ cm (_____ in.)
- 6.3.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM
G-4 Breshna Kot

7.0 CORROSION

7.1 CATHODIC PROTECTION SYSTEM: N/A

7.2 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8.0 DC SYSTEM

- a. Nominal Voltage: 24 volts
- b. Battery:
 - 8.1.b.1 Cell type: Wet type battery
 - 8.1.b.2 Number of cells: 2 cells
 - 8.1.b.3 Battery Charger (describe): N/A
 - 8.1.b.4 DC amps: N/A

9.0 CONTROL HOUSE

9.1 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

- a. Power line carrier
- b. Audio tone
- c. Carrier or audio tone on shield wire
- d. Microwave (analog, digital, or MAS): Mobile Cell Phone
- e. Fiber optics
- f. Wire lines

10.0 Any Other Information: This generator has a fuel injector problem.

DIESEL GENERATOR INSPECTION FORM

G-5 Breshna Kot

1.0 GENERAL

1.1 Inspection Date: 18/11/2014

1.2 Site Location : Breshna Kot

1.3 Site Description (Including total number of Gensets): Breshna Kot diesel power plant is located on center of Kandahar city, there are 7 units diesel generators 1906kVA, 50HZ, 400V, 3phase each.

1.4 Investigators :

a.

b.

c.

d.

1.5 Po

a.

b.

c.

1.6 Diesel Generator Number: No, 5

1.7 GPS Coordinate: 31.629534°, 65.708998°

1.8 Genset General Condition: Nonfunctional

1.9 Genset age(Year of installation): December, 2012

DIESEL GENERATOR INSPECTION FORM

G-5 Breshna Kot

2.0 GENERATORS DATA

- 2.1 Manufacturer: mtu
- 2.2 Serial Number: 335726-1-14-0911
- 2.3 Model Number: 1800FXC5D(G63)
- 2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 16 cylinders generator and feed by the diesel fuel and has 4 turbo systems 2 turbo each side.
- 2.5 Output Power Rating 1525kW, 1906KVA
- 2.6 Operation Condition: Good Fair Not Operational
- 2.7 Condition Notes: This generator is not functional.
- 2.8 Operating Hours: N/A
- 2.9 Fuel Usage (Litters/hours): N/A
- 2.10 Typical Operation (Hours/day, continues, standby, load etc.): N/A
- 2.11 Maintenance Records: (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.
- 250 Hours maintenance: Clean the air filter, oil filter and clean the engine.
- 500 Hours maintenance: Change the air filter, oil filter and engine oil.
- 18000 Hours maintenance: General Service of the generator, which maintenance team doesn't have enough spear part for the general service.
- 2.12 Present Engine Running Period: N/A
- 2.13 Turbo Charger Installation Possibility: Presently there are four turbo are installed in this generator as depicted in the pictures.

3.0 SITE

- 3.1 GENERAL
- a. Yard Type (flat, sloped, stepped): Flat
- 3.2 DRAINAGE
- a. Type of System (surface or closed): Closed
- 3.3 YARD SURFACING MATERIAL
- a. Material:
- 3.3.a.1 Type: Concrete
- 3.3.a.2 Size: 2(4.45x1.2)m

DIESEL GENERATOR INSPECTION FORM
G-5 Breshna Kot

3.4 SECURITY FENCE

- a. Height: N/A
- b. Fabric Material: N/A
- c. Vehicle Gates (itemize as listed below for each size gate):
- d. Size: 2.8-4.0 m
- e. Quantity: 1

DIESEL GENERATOR INSPECTION FORM

G-5 Breshna Kot

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House: This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

Generator House Ventilation System Description: Outdoor

4.2 EXTERNAL DIMENSIONS

- a. Length: 12.30 m
- b. Width: 2.40 m
- c. Clear Height: 3 m

4.3 SUPERSTRUCTURE

- a. Type (pre-engineered metal or concrete block): N/A
- b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM
G-5 Breshna Kot

5.0 GROUNDING

5.1 GROUND CONNECTIONS

- a. Steel:
 - 5.1.a.1 Type Conductor: N/A
 - 5.1.a.2 Size: N/A
 - 5.1.a.3 Connector: N/A
- b. Equipment:
 - 5.1.b.1 Type Conductor: Copper conductor
 - 5.1.b.2 Size: N/A
 - 5.1.b.3 Connector: Yes
- c. Fence:
 - 5.1.c.1 Type Conductor: N/A
 - 5.1.c.2 Size: N/A
 - 5.1.c.3 Connector: N/A

6.0 RACEWAYS

6.1 Conduit: N/A

- a. Material _____
- b. Size _____ cm (_____ in.)

6.2 Duct Bank: N/A

- a. Size
 - 6.2.a.1 Material: _____
 - 6.2.a.2 Width _____ m (_____ ft)
 - 6.2.a.3 Depth _____ m (_____ ft)
 - 6.2.a.4 Size of conduits _____ cm (_____ in.)

6.3 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete):

Cast-in-place concrete

- 6.3.a.1 Width _____ cm (_____ in.)
- 6.3.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM
G-5 Breshna Kot

7.0 CORROSION

7.1 CATHODIC PROTECTION SYSTEM: N/A

7.2 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8.0 DC SYSTEM

a. Nominal Voltage: 24 volts

b. Battery:

8.1.b.1 Cell type: Wet type battery

8.1.b.2 Number of cells: 2 cells

8.1.b.3 Battery Charger (describe): N/A

8.1.b.4 DC amps: N/A

9.0 CONTROL HOUSE

9.1 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

a. Power line carrier

b. Audio tone

c. Carrier or audio tone on shield wire

d. Microwave (analog, digital, or MAS): Mobile Cell Phone

e. Fiber optics

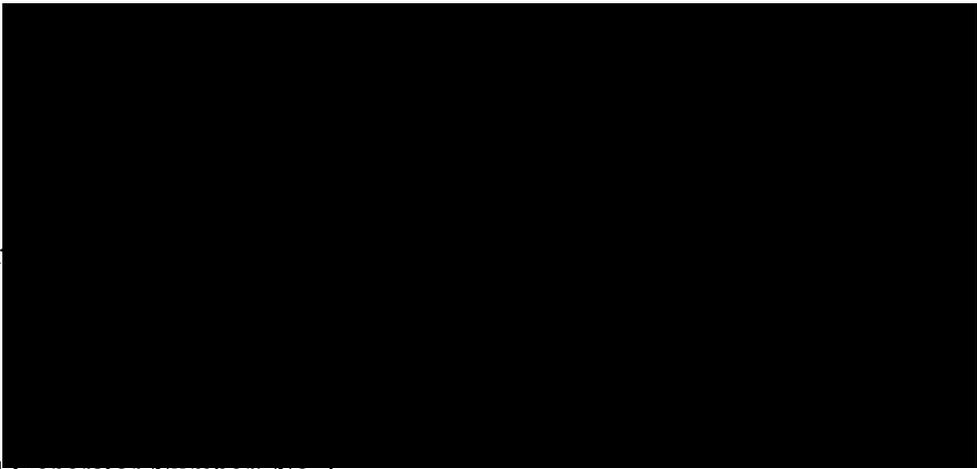
f. Wire lines

10.0 Any Other Information: Engine of this generator is damaged.

DIESEL GENERATOR INSPECTION FORM

G-6 Breshna Kot

1.0 GENERAL

- 1.1 Inspection Date: 18/11/2014
- 1.2 Site Location : Breshna Kot
- 1.3 Site Description (Including total number of Gensets): Breshna Kot diesel power plant is located on center of Kandahar city, there are 7 units diesel generators 1906kVA, 50HZ, 400V, 3phase each.
- 1.4 Investigators :
 - a. 
 - b. 
 - c. 
 - d. 
- 1.5 Power
 - a. 
 - b. 
 - c. 
- 1.6 Diesel Generator Number: NO, 6
- 1.7 GPS Coordinate: 31.629534°, 65.708998°
- 1.8 Genset General Condition: Functional
- 1.9 Genset age(Year of installation): December, 2012

DIESEL GENERATOR INSPECTION FORM
G-6 Breshna Kot

2.0 GENERATORS DATA

- 2.1 Manufacturer: mtu
- 2.2 Serial Number: 335726-1-1-0911
- 2.3 Model Number: 1800FXC5D(G63)
- 2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 16 cylinders generator and feed by the diesel fuel and has 4 turbo systems 2 turbo each side.
- 2.5 Output Power Rating 1525kW, 1906KVA
- 2.6 Operation Condition: Good Fair Not Operational
- 2.7 Condition Notes: The overall generator is good. This generator is functional. The generator runs when the Kajaki power is off. This generator operated and maintenance by DABS. DABS 80% load this generator.
- 2.8 Operating Hours: 3297
- 2.9 Fuel Usage (Litters/hours): 280Litters/ Hour according to power plant manager
- 2.10 Typical Operation (Hours/day, continues, standby, load etc.): When the Kajaki power is off.
- 2.11 Maintenance Records: (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.
250 Hours maintenance: Clean the air filter, oil filter and clean the engine.
500 Hours maintenance: Change the air filter, oil filter and engine oil.
18000 Hours maintenance: General Service of the generator, which maintenance team doesn't have enough spear part for the general service.
- 2.12 Present Engine Running Period: 3297 hours
- 2.13 Turbo Charger Installation Possibility: Presently there are four turbo are installed in this generator as depicted in the pictures.

3.0 SITE

- 3.1 GENERAL
- a. Yard Type (flat, sloped, stepped): Flat
- 3.2 DRAINAGE
- a. Type of System (surface or closed): Closed

DIESEL GENERATOR INSPECTION FORM
G-6 Breshna Kot

3.3 YARD SURFACING MATERIAL

a. Material:

3.3.a.1 Type: Concrete

3.3.a.2 Size: 2(4.45x1.2)m

3.4 SECURITY FENCE

a. Height: N/A

b. Fabric Material: N/A

c. Vehicle Gates (itemize as listed below for each size gate):

d. Size: 2.8-4.0 m

e. Quantity: 1

DIESEL GENERATOR INSPECTION FORM

G-6 Breshna Kot

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House: This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

Generator House Ventilation System Description: Outdoor

4.2 EXTERNAL DIMENSIONS

- a. Length: 12.30 m
- b. Width: 2.40 m
- c. Clear Height: 3 m

4.3 SUPERSTRUCTURE

- a. Type (pre-engineered metal or concrete block): N/A
- b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM
G-6 Breshna Kot

5.0 GROUNDING

5.1 GROUND CONNECTIONS

- a. Steel:
 - 5.1.a.1 Type Conductor: N/A
 - 5.1.a.2 Size: N/A
 - 5.1.a.3 Connector: N/A
- b. Equipment:
 - 5.1.b.1 Type Conductor: Copper conductor
 - 5.1.b.2 Size: N/A
 - 5.1.b.3 Connector: Yes
- c. Fence:
 - 5.1.c.1 Type Conductor: N/A
 - 5.1.c.2 Size: N/A
 - 5.1.c.3 Connector: N/A

6.0 RACEWAYS

6.1 Conduit: N/A

- a. Material _____
- b. Size _____ cm (_____ in.)

6.2 Duct Bank: N/A

- a. Size
 - 6.2.a.1 Material: _____
 - 6.2.a.2 Width _____ m (_____ ft)
 - 6.2.a.3 Depth _____ m (_____ ft)
 - 6.2.a.4 Size of conduits _____ cm (_____ in.)

6.3 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete):
Cast-in-place concrete
 - 6.3.a.1 Width _____ cm (_____ in.)
 - 6.3.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM
G-6 Breshna Kot

7.0 CORROSION

7.1 CATHODIC PROTECTION SYSTEM: N/A

7.2 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8.0 DC SYSTEM

- a. Nominal Voltage: 24 volts
- b. Battery:
 - 8.1.b.1 Cell type: Wet type battery
 - 8.1.b.2 Number of cells: 2 cells
 - 8.1.b.3 Battery Charger (describe): N/A
 - 8.1.b.4 DC amps: N/A

9.0 CONTROL HOUSE

9.1 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

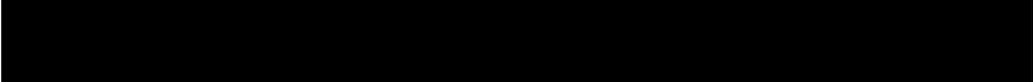
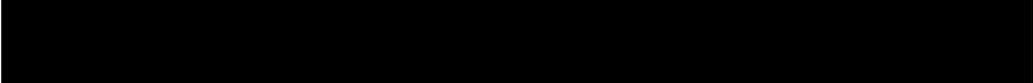
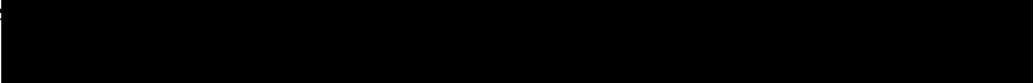
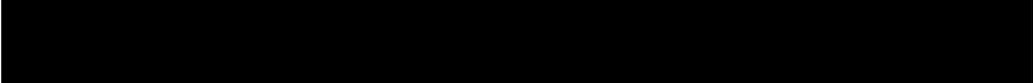
- a. Power line carrier
- b. Audio tone
- c. Carrier or audio tone on shield wire
- d. Microwave (analog, digital, or MAS): Mobile Cell Phone
- e. Fiber optics
- f. Wire lines

10.0 Any Other Information: Nil

DIESEL GENERATOR INSPECTION FORM

G-7 Breshna Kot

1.0 GENERAL

- 1.1 Inspection Date: 18/11/2014
- 1.2 Site Location : Breshna Kot
- 1.3 Site Description (Including total number of Gensets): Breshna Kot diesel power plant is located on center of Kandahar city, there are 7 units' diesel generators 1906kVA, 50HZ, 400V, 3phase each.
- 1.4 Investigators :
 - a. 
 - b. 
 - c. 
 - d. 
- 1.5 Powe
 - a. 
 - b. 
 - c. 
- 1.6 Diesel Generator Number: No, 7
- 1.7 GPS Coordinate: 31.629534°, 65.708998°
- 1.8 Genset General Condition: Functional
- 1.9 Genset age(Year of installation): December, 2012

DIESEL GENERATOR INSPECTION FORM

G-7 Breshna Kot

2.0 GENERATORS DATA

- 2.1 Manufacturer: mtu
- 2.2 Serial Number: 335726-1-8-0911
- 2.3 Model Number: 1800FXC5D(G63)
- 2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 16 cylinders generator and feed by the diesel fuel and has 4 turbo systems 2 turbo each side.
- 2.5 Output Power Rating 1525kW, 1906KVA
- 2.6 Operation Condition: Good Fair Not Operational
- 2.7 Condition Notes: The overall generator is good. This generator is functional. The generator runs when the Kajaki power is off. This generator operated and maintenance by DABS. DABS 80% load this generator.
- 2.8 Operating Hours: 2601
- 2.9 Fuel Usage (Litters/hours): 280Litters/ Hour according to power plant manager
- 2.10 Typical Operation (Hours/day, continues, standby, load etc.): When the Kajaki power is off.
- 2.11 Maintenance Records: (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.
250 Hours maintenance: Clean the air filter, oil filter and clean the engine.
500 Hours maintenance: Change the air filter, oil filter and engine oil.
18000 Hours maintenance: General Service of the generator, which maintenance team doesn't have enough spear part for the general service.
- 2.12 Present Engine Running Period: 2601 hours
- 2.13 Turbo Charger Installation Possibility: presently there are four turbo are installed in this generator as depicted in the pictures.

3.0 SITE

- 3.1 GENERAL
- a. Yard Type (flat, sloped, stepped): Flat
- 3.2 DRAINAGE
- a. Type of System (surface or closed): Closed

DIESEL GENERATOR INSPECTION FORM
G-7 Breshna Kot

3.3 YARD SURFACING MATERIAL

a. Material:

3.3.a.1 Type: Concrete

3.3.a.2 Size: 2(4.45x1.2)m

3.4 SECURITY FENCE

a. Height: N/A

b. Fabric Material: N/A

c. Vehicle Gates (itemize as listed below for each size gate):

d. Size: 2.8-4.0 m

e. Quantity: 1

DIESEL GENERATOR INSPECTION FORM

G-7 Breshna Kot

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House: This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

Generator House Ventilation System Description: Outdoor

4.2 EXTERNAL DIMENSIONS

- a. Length: 12.30 m
- b. Width: 2.40 m
- c. Clear Height: 3 m

4.3 SUPERSTRUCTURE

- a. Type (pre-engineered metal or concrete block): N/A
- b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM
G-7 Breshna Kot

5.0 GROUNDING

5.1 GROUND CONNECTIONS

- a. Steel:
 - 5.1.a.1 Type Conductor: N/A
 - 5.1.a.2 Size: N/A
 - 5.1.a.3 Connector: N/A
- b. Equipment:
 - 5.1.b.1 Type Conductor: Copper conductor
 - 5.1.b.2 Size: N/A
 - 5.1.b.3 Connector: Yes
- c. Fence:
 - 5.1.c.1 Type Conductor: N/A
 - 5.1.c.2 Size: N/A
 - 5.1.c.3 Connector: N/A

6.0 RACEWAYS

6.1 Conduit: N/A

- a. Material _____
- b. Size _____ cm (_____ in.)

6.2 Duct Bank: N/A

- a. Size
 - 6.2.a.1 Material: _____
 - 6.2.a.2 Width _____ m (_____ ft)
 - 6.2.a.3 Depth _____ m (_____ ft)
 - 6.2.a.4 Size of conduits _____ cm (_____ in.)

6.3 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete):

Cast-in-place concrete

- 6.3.a.1 Width _____ cm (_____ in.)
- 6.3.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM
G-7 Breshna Kot

7.0 CORROSION

7.1 CATHODIC PROTECTION SYSTEM: N/A

7.2 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8.0 DC SYSTEM

a. Nominal Voltage: 24 volts

b. Battery:

8.1.b.1 Cell type: Wet type battery

8.1.b.2 Number of cells: 2 cells

8.1.b.3 Battery Charger (describe): N/A

8.1.b.4 DC amps: N/A

9.0 CONTROL HOUSE

9.1 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

a. Power line carrier

b. Audio tone

c. Carrier or audio tone on shield wire

d. Microwave (analog, digital, or MAS): Mobile Cell Phone

e. Fiber optics

f. Wire lines

10.0 Any Other Information: Nil

Generator 1 Breshna Kot



Generator 1 Breshan Kot



Generator 2 Breshna Kot



Generator 2 Breshna Kot



Generator 3 Breshna Kot



Generator 3 Breshna Kot



Generator 4 Breshna Kot



Generator 4 Breshna Kot



Generator 5 Breshna Kot



Generator 5 Breshna Kot



Generator 6 Breshna Kot



Generator 6 Breshna Kot



Generator 7 Breshna Kot



Generator 7 Breshna Kot



APPENDIX C.3
FIELD SURVEY RESULTS AT SIP

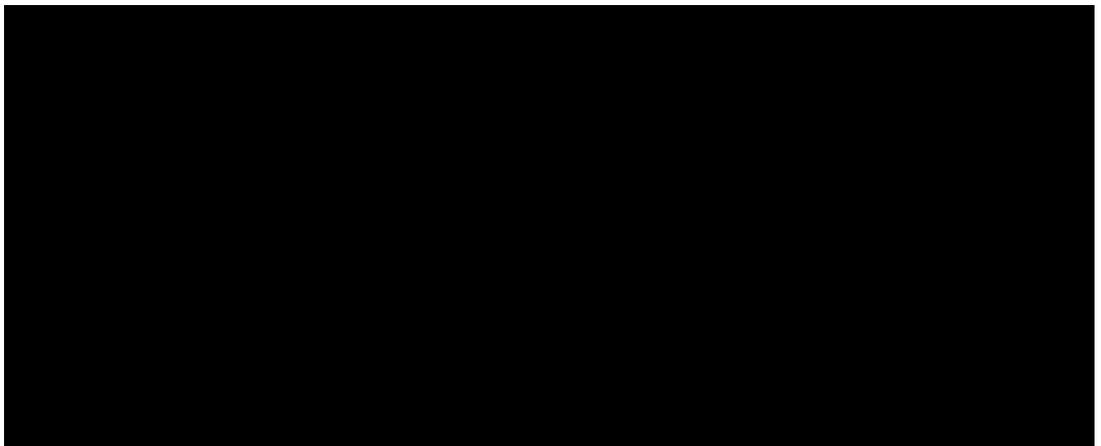
DIESEL GENERATOR INSPECTION FORM

G1 SIP

1.0 GENERAL

- 1.1 Inspection Date: 19 / 11 / 2014
- 1.2 Site Location : Shorandam
- 1.3 Site Description (Including total number of Gensets): The Big-SIP
(Shorandam Industrial Park) Diesel power plant is located on Kandahar
South East, there are 8units each of 2000kVA 3Ph, 50Hz and 0.8Pf.

1.4 Investigators :



- 1.6 Diesel Generator Number: 1
- 1.7 GPS Coordinate: 31.579835°, 65.822972°
- 1.8 Genset General Condition: Not Working
- 1.9 Genset age (Year of installation): 2011

DIESEL GENERATOR INSPECTION FORM

G1 SIP

2 GENERATORS DATA

2.1 Manufacturer : CATERPILLAR

2.2 Serial Number: G6A00730

2.3 Model Number: SR4B-GD

2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 16 cylinders generator and feed by the diesel fuel and has 4 turbo systems 2 turbo in each side.

2.5 Output Power Rating 1600kW, 2000kVA

2.6 Operation Condition: Good Fair Not Operational

2.7 Condition Notes: This generator is nonfunctional, have engine problem.

2.8 Operating Hours: 21458

2.9 Fuel Usage (Litters/hours): N/A

2.10 Typical Operation (Hours/day, continues, standby, load etc.): N/A

2.11 Maintenance Records (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.

250 Hours maintenance: Clean the air filter, oil filter and clean the engine.

500 Hours maintenance: Change the air filter, oil filter and engine oil.

18000 Hours maintenance: General service of the generator, which maintenance team doesn't have enough spear part for the general service.

2.12 Present Engine Running Period: 21458 hours

2.13 Turbo Charger Installation Possibility: Presently there are four turbo are installed in this generator as depicted in the pictures.

DIESEL GENERATOR INSPECTION FORM

G1 SIP

3.0 SITE

3.1 GENERAL

- a. Yard Type (flat, sloped, stepped) : Flat

3.2 DRAINAGE

- a. Type of System (surface or closed): Closed

3.3 YARD SURFACING MATERIAL

- a. Material:

3.3.a.1 Type : Concrete

3.3.a.2 Size: (L x W x H) 80 x 44x 0.1

3.4 SECURITY FENCE

- a. Height : 1.9 m (6.123 ft)
- b. Fabric Material : N/A
- c. Vehicle Gates (itemize as listed below for each size gate):
- d. Size: 2.8 - 4.0 m
- e. Quantity : 1

DIESEL GENERATOR INSPECTION FORM

G1 SIP

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House:

This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

Generator House Ventilation System Description: Out door

4.2 EXTERNAL DIMENSIONS

- a. Length 12.30 m
- b. Width 2.40 m
- c. Clear Height 3m

4.3 SUPERSTRUCTURE

- a. Type (pre-engineered metal or concrete block): N/A
- b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM

G1 SIP

5 GROUNDING

5.3 GROUND CONNECTIONS

- a. Steel:
 - 5.3.a.1 Type Conductor: N/A
 - 5.3.a.2 Size: N/A
- b. Connector: N/A
- c. Equipment:
 - 5.3.c.1 Type Conductor: Copper conductor
 - 5.3.c.2 Size: N/A
 - 5.3.c.3 Connector: Yes
- d. Fence:
 - 5.3.d.1 Type Conductor: N/A
 - 5.3.d.2 Size: N/A
 - 5.3.d.3 Connector: N/A

6 RACEWAYS

6.3 Conduit: N/A

- a. Material
- b. Size _____ cm (_____ in.)

6.4 Duct Bank: N/A

- a. Size
 - 6.4.a.1 Material: _____
 - 6.4.a.2 Width _____ m (_____ ft)
 - 6.4.a.3 Depth _____ m (_____ ft)
 - 6.4.a.4 Size of conduits _____ cm (_____ in.)

6.5 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete)
Cast-in-place concrete
 - 6.5.a.1 Width _____ cm (_____ in.)
 - 6.5.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM

G1 SIP

7 CORROSION

7.3 CATHODIC PROTECTION SYSTEM: N/A

7.4 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8 DC SYSTEM

a. Nominal Voltage 24 volts

b. Battery:

8.3.b.1 Cell type: Dry type battery

8.3.b.2 Number of cells: 2cells

8.3.b.3 Battery Charger (describe): LaMARCHE A 12B Battery charger

8.3.b.4 DC amps: N/A

9 CONTROL HOUSE

9.3 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

a. Power line carrier

b. Audio tone

c. Carrier or audio tone on shield wire

d. Microwave (analog, digital, or MAS): Mobile Cell phone

e. Fiber optics

f. Wire lines

10 Any Other Information: This generator have engine problem and requires general services.

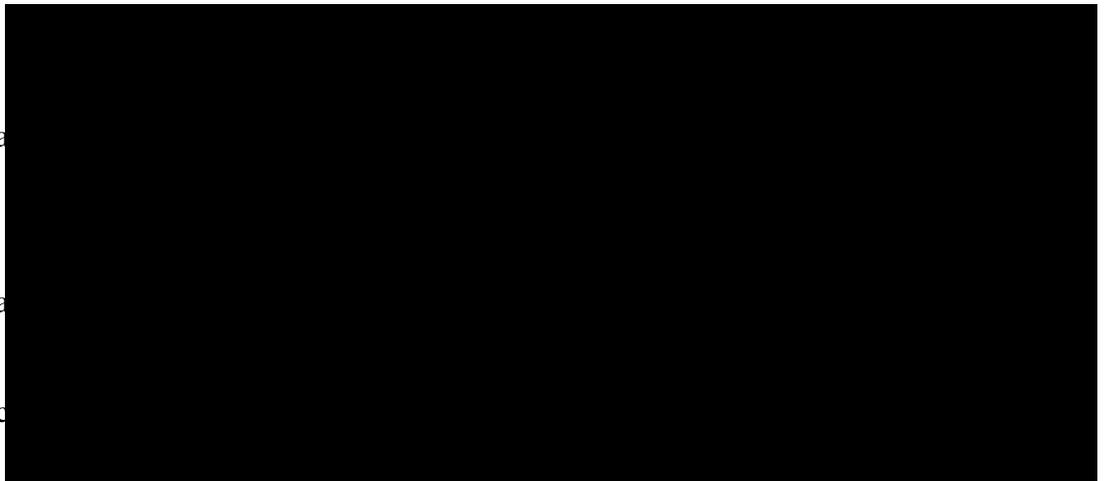
DIESEL GENERATOR INSPECTION FORM

G2 SIP

1.0 GENERAL

- 1.1 Inspection Date: 19 / 11 / 2014
- 1.2 Site Location : Shorandam
- 1.3 Site Description (Including total number of Gensets): The Big-SIP
(Shorandam Industrial Park) Diesel power plant is located on Kandahar
South East, there are 8units each of 2000kVA 3Ph, 50Hz and 0.8Pf.

1.4 Investigators :



- 1.5
- 1.6 Diesel Generator Number: 2
- 1.7 GPS Coordinate: 31.579835°, 65.822972°
- 1.8 Genset General Condition: Functional
- 1.9 Genset age (Year of installation): 2011

DIESEL GENERATOR INSPECTION FORM

G2 SIP

2 GENERATORS DATA

2.1 Manufacturer : CATERPILLAR

2.2 Serial Number: G6A00723

2.3 Model Number: SR4B-GD

2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 16 cylinders generator and feed by the diesel fuel and has 4 turbo systems 2 turbo in each side.

2.5 Output Power Rating 1600kW, 2000kVA

2.6 Operation Condition: Good Fair Not Operational

2.7 Condition Notes: The overall generator is good. This generator is functional
The generator runs 5PM to 12AM local time. This generator operated and maintenance by DABS. As per DABS report 70% load on this generator.

2.8 Operating Hours: 21584

2.9 Fuel Usage (Litters/hours): 288Litters/ Hour, according to the plant manager.

2.10 Typical Operation (Hours/day, continues, standby, load etc.): 24 Hours/Day

2.11 Maintenance Records (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.

250 Hours maintenance: Clean the air filter, oil filter and clean the engine.

500 Hours maintenance: Change the air filter, oil filter and engine oil.

18000 Hours maintenance: General service of the generator, which maintenance team doesn't have enough spear part for the general service.

2.12 Present Engine Running Period: 21584 hours

2.13 Turbo Charger Installation Possibility: Presently there are four turbo are installed in this generator as depicted in the pictures.

DIESEL GENERATOR INSPECTION FORM

G2 SIP

3.0 SITE

3.1 GENERAL

- a. Yard Type (flat, sloped, stepped) : Flat

3.2 DRAINAGE

- a. Type of System (surface or closed): Closed

3.3 YARD SURFACING MATERIAL

- a. Material:

3.3.a.1 Type : Concrete

3.3.a.2 Size: (L x W x H) 80 x 44 x 0.1

3.4 SECURITY FENCE

- a. Height : N/A
- b. Fabric Material : N/A
- c. Vehicle Gates (itemize as listed below for each size gate):N/A
- d. Size: N/A
- e. Quantity : N/A

DIESEL GENERATOR INSPECTION FORM

G2 SIP

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House:

This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

4.2 Generator House Ventilation System Description: Out door

4.3 EXTERNAL DIMENSIONS

- a. Length 12.30 m
- b. Width 2.40 m
- c. Clear Height 3m

4.4 SUPERSTRUCTURE

- a. Type (pre-engineered metal or concrete block): N/A
- b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM

G2 SIP

5.0 GROUNDING

5.0 GROUND CONNECTIONS

- a. Steel:
 - 5.0.a.1 Type Conductor: N/A
 - 5.0.a.2 Size: N/A
 - 5.0.a.3 Connector: N/A
- b. Equipment:
 - 5.0.b.1 Type Conductor: Copper conductor
 - 5.0.b.2 Size: N/A
 - 5.0.b.3 Connector: Yes
- c. Fence:
 - 5.0.c.1 Type Conductor: N/A
 - 5.0.c.2 Size: N/A
 - 5.0.c.3 Connector: N/A

6.0 RACEWAYS

6.1 Conduit: N/A

- a. Material
- b. Size _____ cm (_____ in.)

6.2 Duct Bank: N/A

- a. Size
 - 6.2.a.1 Material: _____
 - 6.2.a.2 Width _____ m (_____ ft)
 - 6.2.a.3 Depth _____ m (_____ ft)
 - 6.2.a.4 Size of conduits _____ cm (_____ in.)

6.3 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete)
 - Cast-in-place concrete
 - 6.3.a.1 Width _____ cm (_____ in.)
 - 6.3.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM G2 SIP

7.0 CORROSION

7.1 CATHODIC PROTECTION SYSTEM: N/A

7.2 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8.0 DC SYSTEM

- a. Nominal Voltage 24 volts
- b. Battery:
 - 8.1.b.1 Cell type: Dry type battery
 - 8.1.b.2 Number of cells: 2cells
 - 8.1.b.3 Battery Charger (describe): LaMARCHE A 12B Battery charger
 - 8.1.b.4 DC amps: N/A

9.0 CONTROL HOUSE

9.1 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

- a. Power line carrier
- b. Audio tone
- c. Carrier or audio tone on shield wire
- d. Microwave (analog, digital, or MAS): Mobile Cell phone
- e. Fiber optics
- f. Wire lines

10.0 Any Other Information: This generator requires general services.

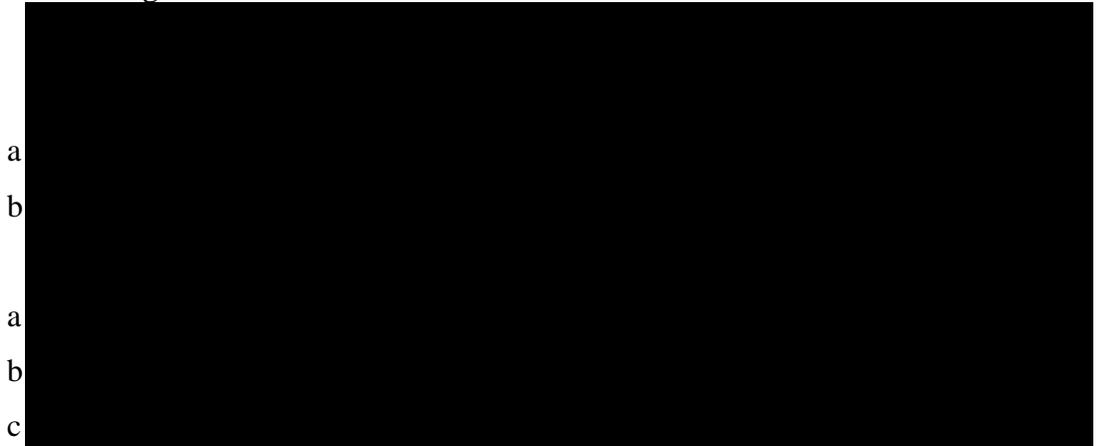
DIESEL GENERATOR INSPECTION FORM

G3 SIP

1.0 GENERAL

- 1.1 Inspection Date: 19/ 11 / 2014
- 1.2 Site Location : Shorandam
- 1.3 Site Description (Including total number of Gensets): The Big-SIP
(Shorandam Industrial Park) Diesel power plant is located on Kandahar
South East, there are 8units each of 2000kVA 3Ph, 50Hz and 0.8Pf.

1.4 Investigators :



- 1.5
- 1.6 Diesel Generator Number: 3
- 1.7 GPS Coordinate: 31.579835°, 65.822972°
- 1.8 Genset General Condition: Not Working
- 1.9 Genset age (Year of installation): 2011

DIESEL GENERATOR INSPECTION FORM

G3 SIP

2 GENERATORS DATA

2.1 Manufacturer : CATERPILLAR

2.2 Serial Number: G6A00726

2.3 Model Number: SR4B-GD

2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 16 cylinders generator and feed by the diesel fuel and has 4 turbo systems 2 turbo in each side.

2.5 Output Power Rating 1600kW, 2000kVA

2.6 Operation Condition: Good Fair Not Operational

2.7 Condition Notes: This generator is not functional, have engine problem.

2.8 Operating Hours: 17560

2.9 Fuel Usage (Litters/hours): N/A

2.10 Typical Operation (Hours/day, continues, standby, load etc.): N/A

2.11 Maintenance Records (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.

250 Hours maintenance: Clean the air filter, oil filter and clean the engine.

500 Hours maintenance: Change the air filter, oil filter and engine oil.

18000 Hours maintenance: General service of the generator, which maintenance team doesn't have enough spear part for the general service.

2.12 Present Engine Running Period: 17560 hours

2.13 Turbo Charger Installation Possibility: Presently there are four turbo are installed in this generator as depicted in the pictures.

DIESEL GENERATOR INSPECTION FORM

G3 SIP

3.0 SITE

3.1 GENERAL

a. Yard Type (flat, sloped, stepped) : Flat

3.2 DRAINAGE

a. Type of System (surface or closed): Closed

3.3 YARD SURFACING MATERIAL

3.3.1 Material:

3.3.a.1 Type : Concrete

3.3.a.2 Size: (L x W x H) 80 x 44 x 0.1

3.4 SECURITY FENCE

3.4.1 Height : 1.9 m (6.123 ft)

3.4.2 Fabric Material : N/A

3.4.3 Vehicle Gates (itemize as listed below for each size gate):

3.4.4 Size: 2.8 - 4.0 m

3.4.5 Quantity : 1

DIESEL GENERATOR INSPECTION FORM

G3 SIP

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House:

This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

4.2 Generator House Ventilation System Description: Out door

4.3 EXTERNAL DIMENSIONS

4.1.1 Length 12.30 m

4.1.2 Width 2.40 m

4.1.3 Clear Height 3m

4.4 SUPERSTRUCTURE

4.4.a. Type (pre-engineered metal or concrete block): N/A

4.4.b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM

G3 SIP

5. GROUNDING

4.3 GROUND CONNECTIONS

- a. Steel:
 - 4.3.a.1 Type Conductor: N/A
 - 4.3.a.2 Size: N/A
- b. Connector: N/A
- c. Equipment:
 - 4.3.c.1 Type Conductor: Copper conductor
 - 4.3.c.2 Size: N/A
 - 4.3.c.3 Connector: Yes
- d. Fence:
 - 4.3.d.1 Type Conductor: N/A
 - 4.3.d.2 Size: N/A
 - 4.3.d.3 Connector: N/A

6. RACEWAYS

- a. Conduit: N/A
 - a. Material
 - b. Size _____ cm (_____ in.)
- b. Duct Bank: N/A
 - a. Size
 - 1. Material: _____
 - 2. Width _____ m (_____ ft)
 - 3. Depth _____ m (_____ ft)
 - 4. Size of conduits _____ cm (_____ in.)
- c. Cable Trench
 - a. Type (concrete block, cast-in-place concrete, or precast concrete)
Cast-in-place concrete
 - 1. Width _____ cm (_____ in.)
 - 2. Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM G3 SIP

7. CORROSION

- a. CATHODIC PROTECTION SYSTEM: N/A
- b. Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8. DC SYSTEM

- a. Nominal Voltage 24 volts
- b. Battery:
 1. Cell type: wet type battery
 2. Number of cells: 2cells
 3. Battery Charger (describe): LaMARCHE A 12B Battery charger
 4. DC amps: N/A

9. CONTROL HOUSE

- a. COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

- a. Power line carrier
- b. Audio tone
- c. Carrier or audio tone on shield wire
- d. Microwave (analog, digital, or MAS): Mobile Cell phone
- e. Fiber optics
- f. Wire lines

10. Any Other Information: Nil

DIESEL GENERATOR INSPECTION FORM

G4 SIP

1.0 GENERAL

- 1.1 Inspection Date: 19 / 11 / 2014
- 1.2 Site Location : Shorandam
- 1.3 Site Description (Including total number of Gensets): The Big-SIP
(Shorandam Industrial Park) Diesel power plant is located on Kandahar
South East, there are 8units each of 2000kVA 3Ph, 50Hz and 0.8Pf.

1.4 Investigators :



1.5

- 1.6 Diesel Generator Number: 4
- 1.7 GPS Coordinate: 31.579835°, 65.822972°
- 1.8 Genset General Condition: Not Working
- 1.9 Genset age (Year of installation): 2011

DIESEL GENERATOR INSPECTION FORM

G4 SIP

2 GENERATORS DATA

2.1 Manufacturer : CATERPILLAR

2.2 Serial Number: G6A00727

2.3 Model Number: SR4B-GD

2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 16 cylinders generator and feed by the diesel fuel and has 4 turbo systems 2 turbo in each side.

2.5 Output Power Rating 1600kW, 2000kVA

2.6 Operation Condition: Good Fair Not Operational

2.7 Condition Notes: This generator is not functional, have engine problem.

2.8 Operating Hours: 17842

2.9 Fuel Usage (Litters/hours): N/A

2.10 Typical Operation (Hours/day, continues, standby, load etc.): N/A

2.11 Maintenance Records (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.

250 Hours maintenance: Clean the air filter, oil filter and clean the engine.

500 Hours maintenance: Change the air filter, oil filter and engine oil.

18000 Hours maintenance: General service of the generator, which maintenance team doesn't have enough spear part for the general service.

2.12 Present Engine Running Period: 17842 hours

2.13 Turbo Charger Installation Possibility: Presently there are four turbo are installed in this generator as depicted in the pictures.

DIESEL GENERATOR INSPECTION FORM

G4 SIP

3.0 SITE

3.1 GENERAL

- a. Yard Type (flat, sloped, stepped) : Flat

3.2 DRAINAGE

- a. Type of System (surface or closed): Closed

3.3 YARD SURFACING MATERIAL

- a. Material:

3.3.a.1 Type : Concrete

3.3.a.2 Size: 80x44x0.1

3.4 SECURITY FENCE

- a. Height : 1.9 m (6.123 ft)
- b. Fabric Material : N/A
- c. Vehicle Gates (itemize as listed below for each size gate):
- d. Size: 2.8 - 4.0 m
- e. Quantity : 1

DIESEL GENERATOR INSPECTION FORM G4 SIP

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House:

This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

Generator House Ventilation System Description: Out door

DIMENSIONS

- a. Length 12.30 m
- b. Width 2.40 m
- c. Clear Height 3m

4.2 SUPERSTRUCTURE

- a. Type (pre-engineered metal or concrete block): N/A
- b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM G4 SIP

5.0 GROUNDING

5.1 GROUND CONNECTIONS

- a. Steel:
 - 5.1.a.1 Type Conductor: N/A
 - 5.1.a.2 Size: N/A
- b. Connector: N/A
- c. Equipment:
 - 5.1.c.1 Type Conductor: Copper conductor
 - 5.1.c.2 Size: N/A
 - 5.1.c.3 Connector: Yes
- d. Fence:
 - 5.1.d.1 Type Conductor: N/A
 - 5.1.d.2 Size: N/A
 - 5.1.d.3 Connector: N/A

6.0 RACEWAYS

6.1 Conduit: N/A

- a. Material
- b. Size _____ cm (_____ in.)

6.2 Duct Bank: N/A

- a. Size
 - 6.2.a.1 Material: _____
 - 6.2.a.2 Width _____ m (_____ ft)
 - 6.2.a.3 Depth _____ m (_____ ft)
 - 6.2.a.4 Size of conduits _____ cm (_____ in.)

6.3 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete)
Cast-in-place concrete
 - 6.3.a.1 Width _____ cm (_____ in.)
 - 6.3.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM G4 SIP

7.0 CORROSION

7.1 CATHODIC PROTECTION SYSTEM: N/A

7.2 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8.0 DC SYSTEM

- a. Nominal Voltage 24 volts
- b. Battery:
 - 8.1.b.1 Cell type: wet type battery
 - 8.1.b.2 Number of cells: 2cells
 - 8.1.b.3 Battery Charger (describe): LaMARCHE A 12B Battery charger
 - 8.1.b.4 DC amps: N/A

9.0 CONTROL HOUSE

9.1 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

- a. Power line carrier
- b. Audio tone
- c. Carrier or audio tone on shield wire
- d. Microwave (analog, digital, or MAS): Mobile Cell phone
- e. Fiber optics
- f. Wire lines

10.0 Any Other Information: Nil

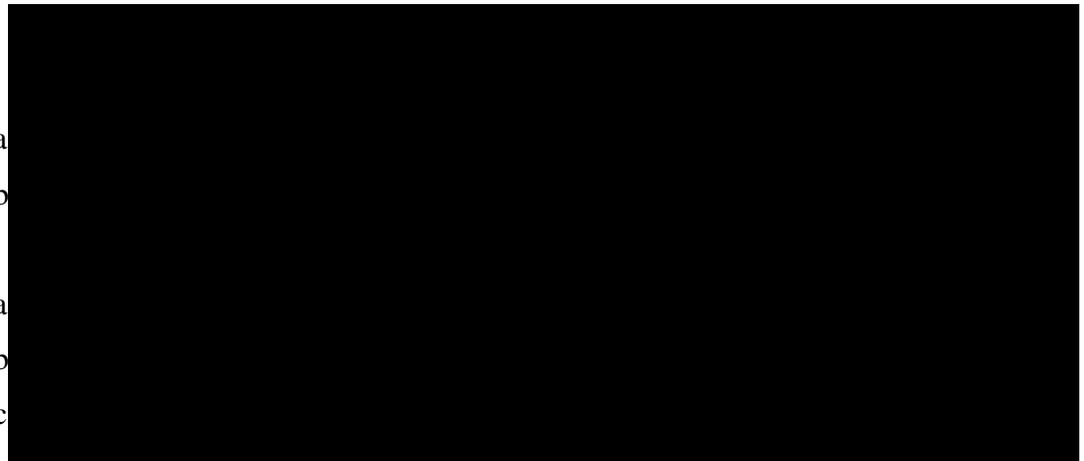
DIESEL GENERATOR INSPECTION FORM

G5 SIP

1.0 GENERAL

- 1.1 Inspection Date: 19/ 11 / 2014
- 1.2 Site Location : Shorandam
- 1.3 Site Description (Including total number of Gensets): The Big-SIP
(Shorandam Industrial Park) Diesel power plant is located on Kandahar
South East, there are 8units each of 2000kVA 3Ph, 50Hz and 0.8Pf.

1.4 Investigators :



- 1.5a
- 1.5b
- 1.5c
- 1.6 Diesel Generator Number: 5
- 1.7 GPS Coordinate: 31.579835°, 65.822972°
- 1.8 Genset General Condition: Not Working
- 1.9 Genset age (Year of installation): 2011

DIESEL GENERATOR INSPECTION FORM

G5 SIP

2 GENERATORS DATA

2.1 Manufacturer : CATERPILLAR

2.2 Serial Number: G6A00763

2.3 Model Number: SR4B-GD

2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 16 cylinders generator and feed by the diesel fuel and has 4 turbo systems 2 turbo in each side.

2.5 Output Power Rating 1600kW, 2000kVA

2.6 Operation Condition: Good Fair Not Operational

2.7 Condition Notes: This generator is not functional, have engine problem.

2.8 Operating Hours: 19244

2.9 Fuel Usage (Litters/hours): N/A

2.10 Typical Operation (Hours/day, continues, standby, load etc.): N/A

2.11 Maintenance Records (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.

250 Hours maintenance: Clean the air filter, oil filter and clean the engine.

500 Hours maintenance: Change the air filter, oil filter and engine oil.

18000 Hours maintenance: General service of the generator, which maintenance team doesn't have enough spear part for the general service.

2.12 Present Engine Running Period: 19244 hours

2.13 Turbo Charger Installation Possibility: Presently there are four turbo are installed in this generator as depicted in the pictures.

DIESEL GENERATOR INSPECTION FORM

G5 SIP

3.0 SITE

3.1 GENERAL

- a. Yard Type (flat, sloped, stepped) : Flat

3.2 DRAINAGE

- a. Type of System (surface or closed): Closed

3.3 YARD SURFACING MATERIAL

- a. Material:

- 3.3.a.1 Type : Concrete

- 3.3.a.2 Size: 80x44x0.1

3.4 SECURITY FENCE

- a. Height : 1.9 m (6.123 ft)
- b. Fabric Material : N/A
- c. Vehicle Gates (itemize as listed below for each size gate):
- d. Size: 2.8 - 4.0 m
- e. Quantity : 1

DIESEL GENERATOR INSPECTION FORM

G5 SIP

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House:

This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

Generator House Ventilation System Description: Out door

DIMENSIONS

- a. Length 12.30 m
- b. Width 2.40 m
- c. Clear Height 3m

4.2 SUPERSTRUCTURE

- a. Type (pre-engineered metal or concrete block): N/A
- b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM G5 SIP

5.0 GROUNDING

5.1 GROUND CONNECTIONS

- a. Steel:
 - 5.1.a.1 Type Conductor: N/A
 - 5.1.a.2 Size: N/A
- b. Connector: N/A
- c. Equipment:
 - 5.1.c.1 Type Conductor: Copper conductor
 - 5.1.c.2 Size: N/A
 - 5.1.c.3 Connector: Yes
- d. Fence:
 - 5.1.d.1 Type Conductor: N/A
 - 5.1.d.2 Size: N/A
 - 5.1.d.3 Connector: N/A

6.0 RACEWAYS

6.1 Conduit: N/A

- a. Material
- b. Size _____ cm (_____ in.)

6.2 Duct Bank: N/A

- a. Size
 - 6.2.a.1 Material: _____
 - 6.2.a.2 Width _____ m (_____ ft)
 - 6.2.a.3 Depth _____ m (_____ ft)
 - 6.2.a.4 Size of conduits _____ cm (_____ in.)

6.3 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete)
Cast-in-place concrete
 - 6.3.a.1 Width _____ cm (_____ in.)
 - 6.3.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM G5 SIP

7.0 CORROSION

7.1 CATHODIC PROTECTION SYSTEM: N/A

7.2 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8.0 DC SYSTEM

- a. Nominal Voltage 24 volts
- b. Battery:
 - 8.1.b.1 Cell type: wet type battery
 - 8.1.b.2 Number of cells: 2cells
 - 8.1.b.3 Battery Charger (describe): LaMARCHE A 12B Battery charger
 - 8.1.b.4 DC amps: N/A

9.0 CONTROL HOUSE

9.1 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

- a. Power line carrier
- b. Audio tone
- c. Carrier or audio tone on shield wire
- d. Microwave (analog, digital, or MAS): Mobile Cell phone
- e. Fiber optics
- f. Wire lines

10.0 Any Other Information: This generator have engine problem and requires general services.

DIESEL GENERATOR INSPECTION FORM

G6 SIP

1.0 GENERAL

- 1.1 Inspection Date: 19/ 11 / 2014
- 1.2 Site Location : Shorandam
- 1.3 Site Description (Including total number of Gensets): The Big-SIP
(Shorandam Industrial Park) Diesel power plant is located on Kandahar
South East, there are 8units each of 2000kVA 3Ph, 50Hz and 0.8Pf.

1.4 Investigators :

- a.
 - b.
- 1.5
- a.
 - b.
 - c.

- 1.6 Diesel Generator Number: 6
- 1.7 GPS Coordinate: 31.579835°, 65.822972°
- 1.8 Genset General Condition: Not Working
- 1.9 Genset age (Year of installation): 2011

DIESEL GENERATOR INSPECTION FORM

G6 SIP

2 GENERATORS DATA

2.1 Manufacturer : CATERPILLAR

2.2 Serial Number: G6A00729

2.3 Model Number: SR4B-GD

2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 16 cylinders generator and feed by the diesel fuel and has 4 turbo systems 2 turbo in each side.

2.5 Output Power Rating 1600kW, 2000kVA

2.6 Operation Condition: Good Fair Not Operational

2.7 Condition Notes: This generator is not functional, have engine problem.

2.8 Operating Hours: 21641

2.9 Fuel Usage (Litters/hours): N/A

2.10 Typical Operation (Hours/day, continues, standby, load etc.): N/A

2.11 Maintenance Records (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.

250 Hours maintenance: Clean the air filter, oil filter and clean the engine.

500 Hours maintenance: Change the air filter, oil filter and engine oil.

18000 Hours maintenance: General service of the generator, which maintenance team doesn't have enough spear part for the general service.

2.12 Present Engine Running Period: 21641 hours

2.13 Turbo Charger Installation Possibility: Presently there are four turbo are installed in this generator as depicted in the pictures.

DIESEL GENERATOR INSPECTION FORM

G6 SIP

3.0 SITE

3.1 GENERAL

- a. Yard Type (flat, sloped, stepped) : Flat

3.2 DRAINAGE

- a. Type of System (surface or closed): Closed

3.3 YARD SURFACING MATERIAL

- a. Material:

- 3.3.a.1 Type : Concrete

- 3.3.a.2 Size: (L x W x H) 80 x 44 x 0.1

3.4 SECURITY FENCE

- a. Height : 1.9 m (6.123 ft)
- b. Fabric Material : N/A
- c. Vehicle Gates (itemize as listed below for each size gate):
- d. Size: 2.8 - 4.0 m
- e. Quantity : 1

DIESEL GENERATOR INSPECTION FORM

G6 SIP

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House:

This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

Generator House Ventilation System Description: Out door

DIMENSIONS

- a. Length 12.30 m
- b. Width 2.40 m
- c. Clear Height 3m

4.2 SUPERSTRUCTURE

- a. Type (pre-engineered metal or concrete block): N/A
- b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM

G6 SIP

5.0 GROUNDING

5.1 GROUND CONNECTIONS

- a. Steel:
 - 5.1.a.1 Type Conductor: N/A
 - 5.1.a.2 Size: N/A
- b. Connector: N/A
- c. Equipment:
 - 5.1.c.1 Type Conductor: Copper conductor
 - 5.1.c.2 Size: N/A
 - 5.1.c.3 Connector: Yes
- d. Fence:
 - 5.1.d.1 Type Conductor: N/A
 - 5.1.d.2 Size: N/A
 - 5.1.d.3 Connector: N/A

6.0 RACEWAYS

6.1 Conduit: N/A

- a. Material
- b. Size _____ cm (_____ in.)

6.2 Duct Bank: N/A

- a. Size
 - 6.2.a.1 Material: _____
 - 6.2.a.2 Width _____ m (_____ ft)
 - 6.2.a.3 Depth _____ m (_____ ft)
 - 6.2.a.4 Size of conduits _____ cm (_____ in.)

6.3 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete)
Cast-in-place concrete
 - 6.3.a.1 Width _____ cm (_____ in.)
 - 6.3.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM

G6 SIP

7.0 CORROSION

7.1 CATHODIC PROTECTION SYSTEM: N/A

7.2 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8.0 DC SYSTEM

- a. Nominal Voltage 24 volts
- b. Battery:
 - 8.1.b.1 Cell type: wet type battery
 - 8.1.b.2 Number of cells: 2cells
 - 8.1.b.3 Battery Charger (describe): LaMARCHE A 12B Battery charger
 - 8.1.b.4 DC amps: N/A

9.0 CONTROL HOUSE

9.1 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

- a. Power line carrier
- b. Audio tone
- c. Carrier or audio tone on shield wire
- d. Microwave (analog, digital, or MAS): Mobile Cell phone
- e. Fiber optics
- f. Wire lines

10.0 Any Other Information: This generator have engine problem and requires general services.

DIESEL GENERATOR INSPECTION FORM

G7 SIP

1.0 GENERAL

- 1.1 Inspection Date: 19/ 11 / 2014
- 1.2 Site Location : Shorandam
- 1.3 Site Description (Including total number of Gensets): The Big-SIP
(Shorandam Industrial Park) Diesel power plant is located on Kandahar
South East, there are 8units each of 2000kVA 3Ph, 50Hz and 0.8Pf.

1.4 Investigators :

a.

b.

1.5

a.

b.

c.

- 1.6 Diesel Generator Number: 7
- 1.7 GPS Coordinate: 31.579835°, 65.822972°
- 1.8 Genset General Condition: Functional
- 1.9 Genset age (Year of installation): 2011

DIESEL GENERATOR INSPECTION FORM

G7 SIP

2 GENERATORS DATA

2.1 Manufacturer : CATERPILLAR

2.2 Serial Number: G6A00728

2.3 Model Number: SR4B-GD

2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 16 cylinders generator and feed by the diesel fuel and has 4 turbo systems 2 turbo in each side.

2.5 Output Power Rating 1600kW, 2000kVA

2.6 Operation Condition: Good Fair Not Operational

2.7 Condition Notes: The overall generator is good. This generator is functional
The generator runs 5PM to 12AM local time. This generator operated and maintenance by DABS. As per DABS report 70% load on this generator.

2.8 Operating Hours: 20938

2.9 Fuel Usage (Litters/hours): 288Litters/ Hour, according to the plant manager.

2.10 Typical Operation (Hours/day, continues, standby, load etc.): 24 Hours/Day

2.11 Maintenance Records (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.

250 Hours maintenance: Clean the air filter, oil filter and clean the engine.

500 Hours maintenance: Change the air filter, oil filter and engine oil.

18000 Hours maintenance: General service of the generator, which maintenance team doesn't have enough spear part for the general service.

2.12 Present Engine Running Period: 20938 hours

2.13 Turbo Charger Installation Possibility: Presently there are four turbo are installed in this generator as depicted in the pictures.

DIESEL GENERATOR INSPECTION FORM

G7 SIP

3.0 SITE

3.1 GENERAL

- a. Yard Type (flat, sloped, stepped) : Flat

3.2 DRAINAGE

- a. Type of System (surface or closed): Closed

3.3 YARD SURFACING MATERIAL

3.3.1 Material:

3.3.a.1 Type : Concrete

3.3.a.2 Size: (L x W x H) 80 x 44 x 0.1

3.4 SECURITY FENCE

3.4.1 Height : 1.9 m (6.123 ft)

3.4.2 Fabric Material : N/A

3.4.3 Vehicle Gates (itemize as listed below for each size gate):

3.4.4 Size: 2.8 - 4.0 m

3.4.5 Quantity : 1

DIESEL GENERATOR INSPECTION FORM

G7 SIP

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House:

This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

Generator House Ventilation System Description: Out door

DIMENSIONS

4.1.1 Length 12.30 m

4.1.2 Width 2.40 m

4.1.3 Clear Height 3m

4.2 SUPERSTRUCTURE

4.2.1 Type (pre-engineered metal or concrete block): N/A

4.2.2 Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM G7 SIP

5.0 GROUNDING

5.1 GROUND CONNECTIONS

5.1.1 Steel:

5.1.1.1 Type Conductor: N/A

5.1.1.2 Size: N/A

5.1.2 Connector: N/A

5.1.3 Equipment:

5.1.3.1 Type Conductor: Copper conductor

5.1.3.2 Size: N/A

5.1.3.3 Connector: Yes

5.1.4 Fence:

5.1.4.1 Type Conductor: N/A

5.1.4.2 Size: N/A

5.1.4.3 Connector: N/A

6.0 RACEWAYS

6.1 Conduit: N/A

6.1.1 Material

6.1.2 Size _____ cm (_____ in.)

6.2 Duct Bank: N/A

6.2.1 Size

6.2.1.1 Material: _____

6.2.1.2 Width _____ m (_____ ft)

6.2.1.3 Depth _____ m (_____ ft)

6.2.1.4 Size of conduits _____ cm (_____ in.)

6.3 Cable Trench

6.3.1 Type (concrete block, cast-in-place concrete, or precast concrete)

Cast-in-place concrete

6.3.1.1 Width _____ cm (_____ in.)

6.3.1.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM

G7 SIP

7.0 CORROSION

7.1 CATHODIC PROTECTION SYSTEM: N/A

7.2 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8.0 DC SYSTEM

8.1.1 Nominal Voltage 24 volts

8.1.2 Battery:

8.1.2.1 Cell type: Dry type battery

8.1.2.2 Number of cells: 2cells

8.1.2.3 Battery Charger (describe): LaMARCHE A 12B Battery charger

8.1.2.4 DC amps: N/A

9.0 CONTROL HOUSE

9.1 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

9.1.1 Power line carrier

9.1.2 Audio tone

9.1.3 Carrier or audio tone on shield wire

9.1.4 Microwave (analog, digital, or MAS): Mobile Cell phone

9.1.5 Fiber optics

9.1.6 Wire lines

10.0 Any Other Information: This generator requires general services.

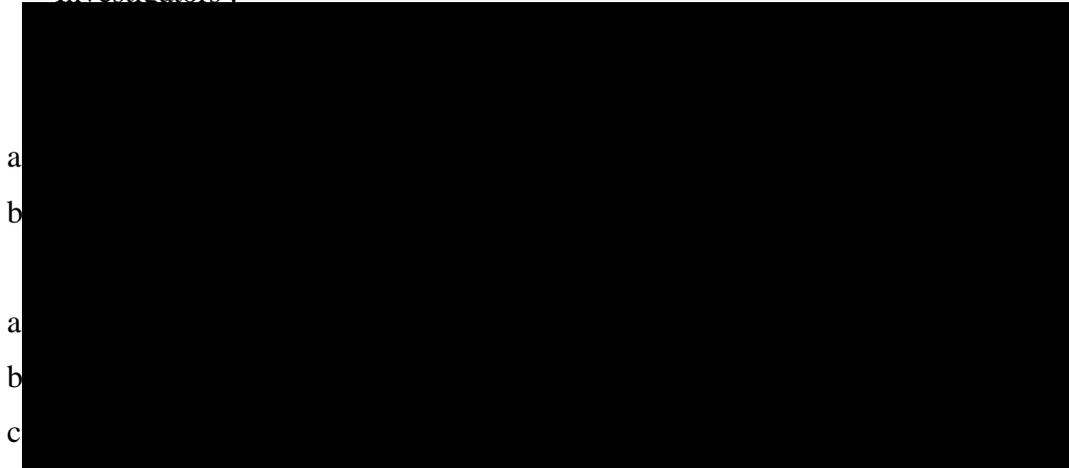
DIESEL GENERATOR INSPECTION FORM

G8 SIP

1.0 GENERAL

- 1.1 Inspection Date: 19 / 11 / 2014
- 1.2 Site Location : Shorandam
- 1.3 Site Description (Including total number of Gensets): The Big-SIP (Shorandam Industrial Park) Diesel power plant is located on Kandahar South East, there are 8units each of 2000kVA 3Ph, 50Hz and 0.8Pf.

1.4 Investigators :



- 1.5
- 1.6 Diesel Generator Number: 8
- 1.7 GPS Coordinate: 31.579835°, 65.822972°
- 1.8 Genset General Condition: Functional
- 1.9 Genset age (Year of installation): 2011

DIESEL GENERATOR INSPECTION FORM

G8 SIP

2 GENERATORS DATA

2.1 Manufacturer : CATERPILLAR

2.2 Serial Number: G6A00724

2.3 Model Number: SR4B-GD

2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 16 cylinders generator and feed by the diesel fuel and has 4 turbo systems 2 turbo in each side.

2.5 Output Power Rating 1600kW, 2000kVA

2.6 Operation Condition: Good Fair Not Operational

2.7 Condition Notes: The overall generator is good. This generator is functional
The generator runs 5PM to 12AM local time. This generator operated and maintenance by DABS. As per DABS report 70% load on this generator.

2.8 Operating Hours: 20336

2.9 Fuel Usage (Litters/hours): 288Litters/ Hour, according to the plant manager.

2.10 Typical Operation (Hours/day, continues, standby, load etc.): 24 Hours/Day

2.11 Maintenance Records (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.

250 Hours maintenance: Clean the air filter, oil filter and clean the engine.

500 Hours maintenance: Change the air filter, oil filter and engine oil.

18000 Hours maintenance: General service of the generator, which maintenance team doesn't have enough spear part for the general service.

2.12 Present Engine Running Period: 20336 hours

2.13 Turbo Charger Installation Possibility: Presently there are four turbo are installed in this generator as depicted in the pictures.

DIESEL GENERATOR INSPECTION FORM

G8 SIP

3.0 SITE

3.1 GENERAL

- a. Yard Type (flat, sloped, stepped) : Flat

3.2 DRAINAGE

- a. Type of System (surface or closed): Closed

3.3 YARD SURFACING MATERIAL

- a. Material:
 - 3.3.a.1 Type : Concrete
 - 3.3.a.2 Size: 80x44x0.1

3.4 SECURITY FENCE

- a. Height : 1.9 m (6.123 ft)
- b. Fabric Material : N/A
- c. Vehicle Gates (itemize as listed below for each size gate):
- d. Size: 2.8 - 4.0 m
- e. Quantity : 1

DIESEL GENERATOR INSPECTION FORM G8 SIP

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House:

This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

Generator House Ventilation System Description: Out door

DIMENSIONS

- a. Length 12.30 m
- b. Width 2.40 m
- c. Clear Height 3m

4.2 SUPERSTRUCTURE

- a. Type (pre-engineered metal or concrete block): N/A
- b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM G8 SIP

5.0 GROUNDING

5.1 GROUND CONNECTIONS

- a. Steel:
 - 5.1.a.1 Type Conductor: N/A
 - 5.1.a.2 Size: N/A
- b. Connector: N/A
- c. Equipment:
 - 5.1.c.1 Type Conductor: Copper conductor
 - 5.1.c.2 Size: N/A
 - 5.1.c.3 Connector: Yes
- d. Fence:
 - 5.1.d.1 Type Conductor: N/A
 - 5.1.d.2 Size: N/A
 - 5.1.d.3 Connector: N/A

6.0 RACEWAYS

6.1 Conduit: N/A

- a. Material
- b. Size _____ cm (_____ in.)

6.2 Duct Bank: N/A

- a. Size
 - 6.2.a.1 Material: _____
 - 6.2.a.2 Width _____ m (_____ ft)
 - 6.2.a.3 Depth _____ m (_____ ft)
 - 6.2.a.4 Size of conduits _____ cm (_____ in.)

6.3 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete)
Cast-in-place concrete
 - 6.3.a.1 Width _____ cm (_____ in.)
 - 6.3.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM G8 SIP

7.0 CORROSION

7.1 CATHODIC PROTECTION SYSTEM: N/A

7.2 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8.0 DC SYSTEM

- a. Nominal Voltage 24 volts
- b. Battery:
 - 8.1.b.1 Cell type: Dry type battery
 - 8.1.b.2 Number of cells: 2cells
 - 8.1.b.3 Battery Charger (describe): LaMARCHE A 12B Battery charger
 - 8.1.b.4 DC amps: N/A

9.0 CONTROL HOUSE

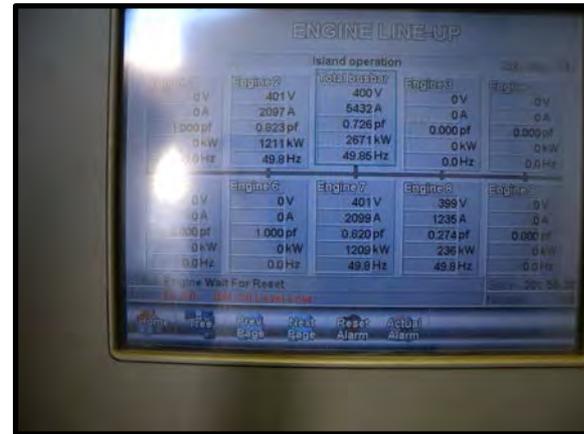
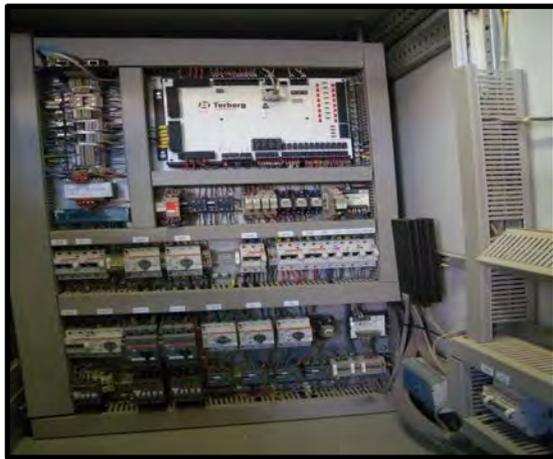
9.1 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

- a. Power line carrier
- b. Audio tone
- c. Carrier or audio tone on shield wire
- d. Microwave (analog, digital, or MAS)
- e. Fiber optics
- f. Wire lines

10.0 Any Other Information: This generator requires general services.

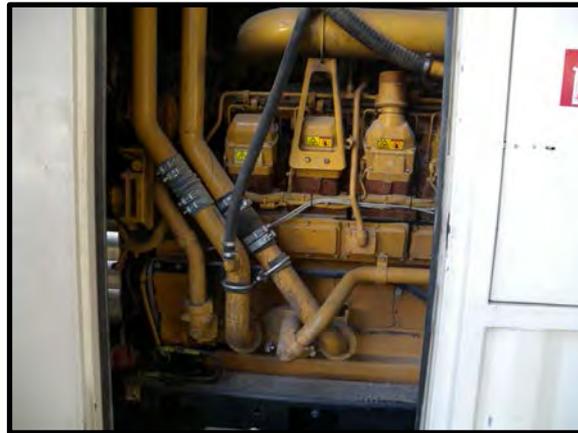
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Generator 1 SIP



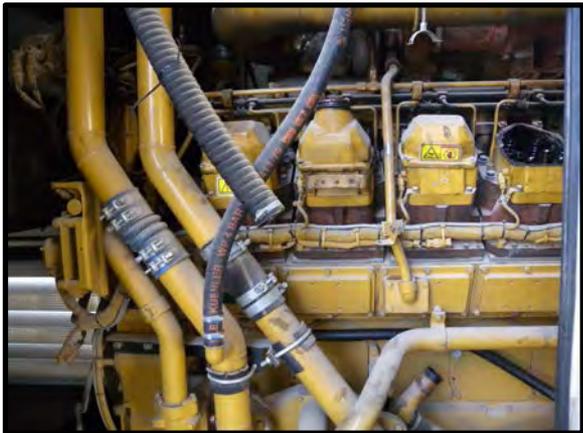
Generator 2 SIP



Generator 2 SIP



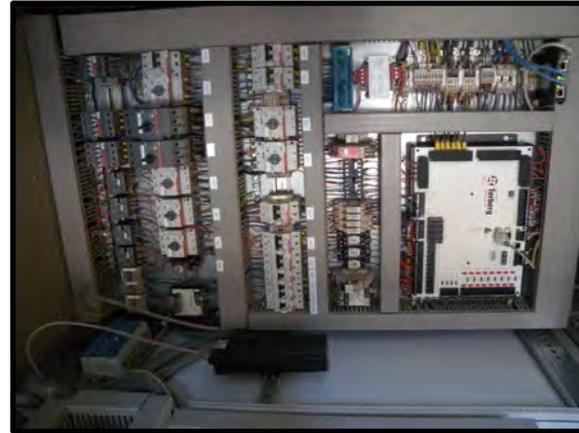
Generator 3 SIP



Generator 3 SIP



Generator 4 SIP



Generator 4 SIP



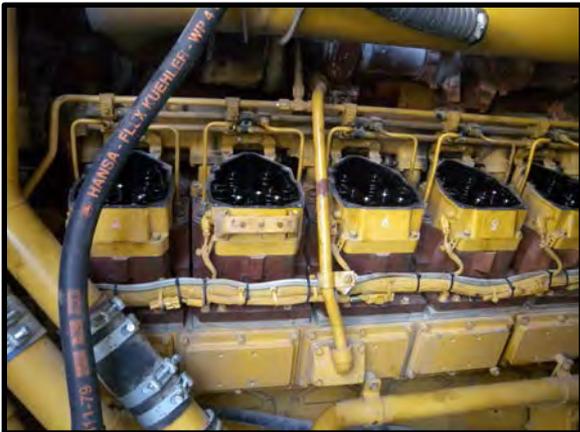
Generator 5 SIP



Generator 5 SIP



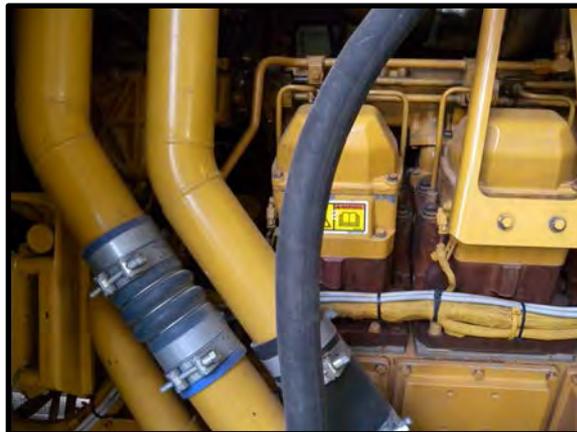
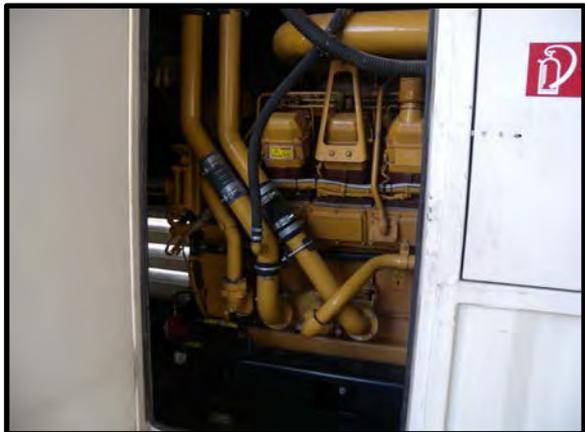
Generator 6 SIP



Generator 6 SIP



Generator 7 SIP



Generator 7 SIP



Generator 8 SIP



Generator 8 SIP



APPENDIX C.4
FIELD SURVEY RESULTS AT LITTLE SIP

DIESEL GENERATOR INSPECTION FORM

G1 Little SIP

1.0 GENERAL

- 1.1 Inspection Date: 19/ 11 / 2014
- 1.2 Site Location : Shorandam
- 1.3 Site Description (Including total number of Gensets): The Small -SIP (Shorandam Industrial Park) Diesel power plant is located on Kandahar South East, there are 10 units each of 810kVA 3Ph, 50Hz and 0.8Pf.

1.4 Investigators :

a.

b.

1.5

a.

b.

c.

- 1.6 Diesel Generator Number: 1
- 1.7 GPS Coordinate: 31.580031°, 65.823059°
- 1.8 Genset General Condition: Not Working
- 1.9 Genset age (Year of installation): 2012

DIESEL GENERATOR INSPECTION FORM

G1 Little SIP

2.0 GENERATORS DATA

2.1 Manufacturer : STAMFORD

2.2 Serial Number: 0228291/007

2.3 Model Number: A07D78899

2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 6 cylinders generator and feed by the diesel fuel and has 1 turbo system.

2.5 Output Power Rating 648kW, 810kVA

2.6 Operation Condition: Good Fair Not Operational

2.7 Condition Notes: This generator is not functional, have engine problem.

2.8 Operating Hours: 5951

2.9 Fuel Usage (Litters/hours): N/A

2.10 Typical Operation (Hours/day, continues, standby, load etc.): N/A

2.11 Maintenance Records (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.

250 Hours maintenance: Clean the air filter, oil filter and clean the engine.

500 Hours maintenance: Change the air filter, oil filter and engine oil.

18000 Hours maintenance: General service of the generator, which maintenance team doesn't have enough spear part for the general service.

2.12 Present Engine Running Period: 5951 hours

2.13 Turbo Charger Installation Possibility: Presently there are one turbo is installed in this generator as depicted in the pictures.

DIESEL GENERATOR INSPECTION FORM

G1 Little SIP

3.0 SITE

3.1 GENERAL

- a. Yard Type (flat, sloped, stepped) : Flat

3.2 DRAINAGE

- a. Type of System (surface or closed): Closed

3.3 YARD SURFACING MATERIAL

- a. Material:

3.3.a.1 Type : Concrete

3.3.a.2 Size: (L x W x H) 40.2 x 8.5 x 0.1

3.4 SECURITY FENCE

- a. Height : N/A
- b. Fabric Material : N/A
- c. Vehicle Gates (itemize as listed below for each size gate):
- d. Size: N/A
- e. Quantity : N/A

DIESEL GENERATOR INSPECTION FORM

G1 Little SIP

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House:

This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

Generator House Ventilation System Description: Out door

4.2 EXTERNAL DIMENSIONS

- a. Length 6.5 m
- b. Width 2.2 m
- c. Clear Height 2.34m

4.3 SUPERSTRUCTURE

- a. Type (pre-engineered metal or concrete block): N/A
- b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM
G1 Little SIP

5 GROUNDING

5.1 GROUND CONNECTIONS

- a. Steel:
 - 5.1.a.1 Type Conductor: N/A
 - 5.1.a.2 Size: N/A
- b. Connector: N/A
- c. Equipment:
 - 5.1.c.1 Type Conductor: Copper conductor
 - 5.1.c.2 Size: N/A
 - 5.1.c.3 Connector: Yes
- d. Fence:
 - 5.1.d.1 Type Conductor: N/A
 - 5.1.d.2 Size: N/A
 - 5.1.d.3 Connector: N/A

6 RACEWAYS

6.1 Conduit: N/A

- a. Material
- b. Size _____ cm (_____ in.)

6.2 Duct Bank: N/A

- a. Size
 - 6.2.a.1 Material: _____
 - 6.2.a.2 Width _____ m (_____ ft)
 - 6.2.a.3 Depth _____ m (_____ ft)
 - 6.2.a.4 Size of conduits _____ cm (_____ in.)

6.3 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete):
Cast-in-place concrete
 - 6.3.a.1 Width _____ cm (_____ in.)
 - 6.3.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM

G1 Little SIP

7 CORROSION

7.1 CATHODIC PROTECTION SYSTEM: N/A

7.2 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8 DC SYSTEM

- a. Nominal Voltage 24 volts
- b. Battery:
 - 8.1.b.1 Cell type: Wet type battery
 - 8.1.b.2 Number of cells: 2cells
 - 8.1.b.3 Battery Charger (describe): N/A
 - 8.1.b.4 DC amps: N/A

9 CONTROL HOUSE

9.1 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

- a. Power line carrier
- b. Audio tone
- c. Carrier or audio tone on shield wire
- d. Microwave (analog, digital, or MAS): Mobile Cell phone
- e. Fiber optics
- f. Wire lines

10 Any Other Information: This generator has engine problem.

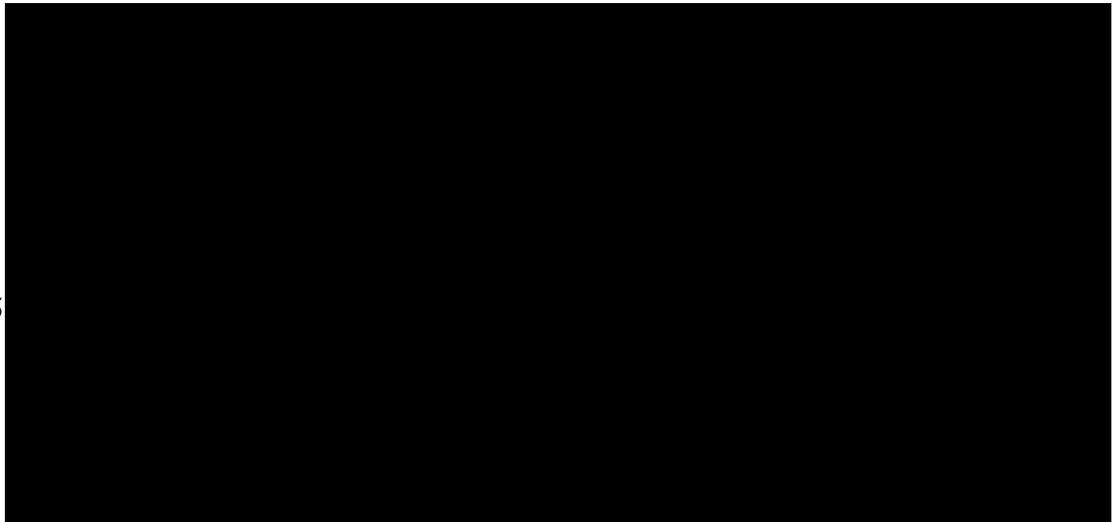
DIESEL GENERATOR INSPECTION FORM

G10 Little SIP

1.0 GENERAL

- 1.1 Inspection Date: 19/ 11 / 2014
- 1.2 Site Location : Shorandam
- 1.3 Site Description (Including total number of Gensets): The Small-SIP (Shorandam Industrial Park) Diesel power plant is located on Kandahar South East, there are 10 units each of 810kVA 3Ph, 50Hz and 0.8Pf.

1.4 Investigators :



1.5

- 1.6 Diesel Generator Number: 10
- 1.7 GPS Coordinate: 31.580031°, 65.823059°
- 1.8 Genset General Condition: Not functional
- 1.9 Genset age (Year of installation): 2012

DIESEL GENERATOR INSPECTION FORM

G10 Little SIP

2.0 GENERATORS DATA

2.1 Manufacturer : STAMFORD

2.2 Serial Number: 02210066/003

2.3 Model Number: A06L707600

2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 6 cylinders generator and feed by the diesel fuel and has 1 turbo system.

2.5 Output Power Rating 648kW, 810kVA

2.6 Operation Condition: Good Fair Not Operational

2.7 Condition Notes: This generator is not functional, has engine problem.

2.8 Operating Hours: 3929

2.9 Fuel Usage (Litters/hours): N/A

2.10 Typical Operation (Hours/day, continues, standby, load etc.): N/A

2.11 Maintenance Records (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.

250 Hours maintenance: Clean the air filter, oil filter and clean the engine.

500 Hours maintenance: Change the air filter, oil filter and engine oil.

18000 Hours maintenance: General service of the generator, which maintenance team doesn't have enough spear part for the general service.

2.12 Present Engine Running Period: 3929 hours

2.13 Turbo Charger Installation Possibility: Presently there are one turbo is installed in this generator as depicted in the pictures.

DIESEL GENERATOR INSPECTION FORM
G10 Little SIP

3.0 SITE

3.1 GENERAL

- a. Yard Type (flat, sloped, stepped) : Flat

3.2 DRAINAGE

- a. Type of System (surface or closed): Closed

3.3 YARD SURFACING MATERIAL

- a. Material:

3.3.a.1 Type : Concrete

3.3.a.2 Size: (L x W x H) 40.2 x 8.5 x 0.1

3.4 SECURITY FENCE

- a. Height : N/A
- b. Fabric Material : N/A
- c. Vehicle Gates (itemize as listed below for each size gate):
- d. Size: N/A
- e. Quantity : N/A

DIESEL GENERATOR INSPECTION FORM

G10 Little SIP

4.0 GENERATORS STRUCTURES

4.1 DESCRIPTION OF GENERATOR HOUSE:

This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

Generator House Ventilation System Description: Out door

4.2 EXTERNAL DIMENSIONS

- a. Length 6.5 m
- b. Width 2.2 m
- c. Clear Height 2.34m

4.3 SUPERSTRUCTURE

- a. Type (pre-engineered metal or concrete block): N/A
- b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM
G10 Little SIP

5.0 GROUNDING

5.1 GROUND CONNECTIONS

- a. Steel:
 - 5.1.a.1 Type Conductor: N/A
 - 5.1.a.2 Size: N/A
 - 5.1.a.3 Connector: N/A
- b. Equipment:
 - 5.1.b.1 Type Conductor: Copper conductor
 - 5.1.b.2 Size: N/A
 - 5.1.b.3 Connector: Yes
- c. Fence:
 - 5.1.c.1 Type Conductor: N/A
 - 5.1.c.2 Size: N/A
 - 5.1.c.3 Connector: N/A

6.0 RACEWAYS

6.1 Conduit: N/A

- a. Material
- b. Size _____ cm (_____ in.)

6.2 Duct Bank: N/A

- a. Size
 - 6.2.a.1 Material: _____
 - 6.2.a.2 Width _____ m (_____ ft)
 - 6.2.a.3 Depth _____ m (_____ ft)
 - 6.2.a.4 Size of conduits _____ cm (_____ in.)

6.3 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete)

Cast-in-place concrete

- 6.3.a.1 Width _____ cm (_____ in.)
- 6.3.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM

G10 Little SIP

7.0 CORROSION

7.1 CATHODIC PROTECTION SYSTEM: N/A

7.2 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8.0 DC SYSTEM

- a. Nominal Voltage: 24 volts
- b. Battery:
 - 8.1.b.1 Cell type: Wet type battery
 - 8.1.b.2 Number of cells: 2cells
 - 8.1.b.3 Battery Charger (describe): N/A
 - 8.1.b.4 DC amps: N/A

9.0 CONTROL HOUSE

9.1 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

- a. Power line carrier
- b. Audio tone
- c. Carrier or audio tone on shield wire
- d. Microwave (analog, digital, or MAS): Mobile Cell phone
- e. Fiber optics
- f. Wire lines

10.0 Any Other Information: This generator has engine problem.

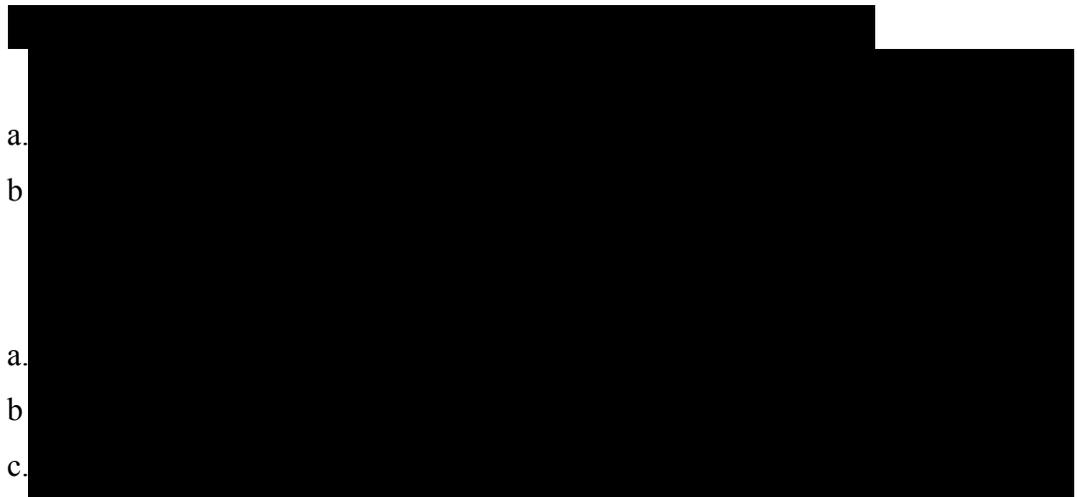
DIESEL GENERATOR INSPECTION FORM

G2 Little SIP

1.0 GENERAL

- 1.1 Inspection Date: 19 / 11 / 2014
- 1.2 Site Location : Shorandam
- 1.3 Site Description (Including total number of Gensets): The Small-SIP (Shorandam Industrial Park) Diesel power plant is located on Kandahar South East, there are 10 units each of 810kVA 3Ph, 50Hz and 0.8Pf.

1.4 Investigators :



- 1.5
- 1.6 Diesel Generator Number: 2
- 1.7 GPS Coordinate: 31.580031°, 65.823059°
- 1.8 Genset General Condition: Not Working
- 1.9 Genset age (Year of installation): 2012

DIESEL GENERATOR INSPECTION FORM

G2 Little SIP

2 GENERATORS DATA

2.1 Manufacturer : STAMFORD

2.2 Serial Number: 0228291/003

2.3 Model Number: A07D780416

2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 6 cylinders generator and feed by the diesel fuel and has 1 turbo system.

2.5 Output Power Rating 648kW, 810kVA

2.6 Operation Condition: Good Fair Not Operational

2.7 Condition Notes: This generator is not functional, has engine problem.

2.8 Operating Hours: 5851

2.9 Fuel Usage (Litters/hours): N/A

2.10 Typical Operation (Hours/day, continues, standby, load etc.): N/A

2.11 Maintenance Records (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.

250 Hours maintenance: Clean the air filter, oil filter and clean the engine.

500 Hours maintenance: Change the air filter, oil filter and engine oil.

18000 Hours maintenance: General service of the generator, which maintenance team doesn't have enough spear part for the general service.

2.12 Present Engine Running Period: 5851 hours

2.13 Turbo Charger Installation Possibility: Presently there are one turbo is installed in this generator as depicted in the pictures.

DIESEL GENERATOR INSPECTION FORM
G2 Little SIP

3.0 SITE

3.1 GENERAL

- a. Yard Type (flat, sloped, stepped) : Flat

3.2 DRAINAGE

- a. Type of System (surface or closed): Closed

3.3 YARD SURFACING MATERIAL

- a. Material:

3.3.a.1 Type : Concrete

3.3.a.2 Size: (L x W x H) 40.2 x 8.5 x 0.1

3.4 SECURITY FENCE

- a. Height : N/A
- b. Fabric Material : N/A
- c. Vehicle Gates (itemize as listed below for each size gate):
- d. Size: N/A
- e. Quantity : N/A

DIESEL GENERATOR INSPECTION FORM

G2 Little SIP

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House:

This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

Generator House Ventilation System Description: Out door

4.2 EXTERNAL DIMENSIONS

- a. Length 6.5 m
- b. Width 2.2 m
- c. Clear Height 2.34m

4.3 SUPERSTRUCTURE

- a. Type (pre-engineered metal or concrete block): N/A
- b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM
G2 Little SIP

5 GROUNDING

5.3 GROUND CONNECTIONS

- a. Steel:
 - 5.3.a.1 Type Conductor: N/A
 - 5.3.a.2 Size: N/A
- b. Connector: N/A
- c. Equipment:
 - 5.3.c.1 Type Conductor: Copper conductor
 - 5.3.c.2 Size: N/A
 - 5.3.c.3 Connector: Yes
- d. Fence:
 - 5.3.d.1 Type Conductor: N/A
 - 5.3.d.2 Size: N/A
 - 5.3.d.3 Connector: N/A

6 RACEWAYS

6.3 Conduit: N/A

- a. Material
- b. Size _____ cm (_____ in.)

6.4 Duct Bank: N/A

- a. Size
 - 6.4.a.1 Material: _____
 - 6.4.a.2 Width _____ m (_____ ft)
 - 6.4.a.3 Depth _____ m (_____ ft)
 - 6.4.a.4 Size of conduits _____ cm (_____ in.)

6.5 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete)
Cast-in-place concrete
 - 6.5.a.1 Width _____ cm (_____ in.)
 - 6.5.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM

G2 Little SIP

7 CORROSION

7.3 CATHODIC PROTECTION SYSTEM: N/A

7.4 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8 DC SYSTEM

- a. Nominal Voltage 24 volts
- b. Battery:
 - 8.3.b.1 Cell type: Wet type battery
 - 8.3.b.2 Number of cells: 2cells
 - 8.3.b.3 Battery Charger (describe): N/A
 - 8.3.b.4 DC amps: N/A

9 CONTROL HOUSE

9.3 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

- a. Power line carrier
- b. Audio tone
- c. Carrier or audio tone on shield wire
- d. Microwave (analog, digital, or MAS): Mobile Cell phone
- e. Fiber optics
- f. Wire lines

10 Any Other Information: This generator has engine problem.

DIESEL GENERATOR INSPECTION FORM

G3 Little SIP

1.0 GENERAL

- 1.1 Inspection Date: 19/ 11 / 2014
- 1.2 Site Location : Shorandam
- 1.3 Site Description (Including total number of Gensets): The Small-SIP (Shorandam Industrial Park) Diesel power plant is located on Kandahar South East, there are 10 units each of 810kVA 3Ph, 50Hz and 0.8Pf.
- 1.4 Investigators :
 - a.
 - b.
- 1.5
 - a.
 - b.
 - c.
- 1.6 Diesel Generator Number: 3
- 1.7 GPS Coordinate: 31.580031°, 65.823059°
- 1.8 Genset General Condition: Not Working
- 1.9 Genset age (Year of installation): 2012

DIESEL GENERATOR INSPECTION FORM

G3 Little SIP

2 GENERATORS DATA

2.1 Manufacturer : STAMFORD

2.2 Serial Number: 0217753/002

2.3 Model Number: A07A721372

2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 6 cylinders generator and feed by the diesel fuel and has 1 turbo system.

2.5 Output Power Rating 648kW, 810kVA

2.6 Operation Condition: Good Fair Not Operational

2.7 Condition Notes: This generator is not functional, has engine problem.

2.8 Operating Hours: 5604

2.9 Fuel Usage (Litters/hours): N/A

2.10 Typical Operation (Hours/day, continues, standby, load etc.): N/A

2.11 Maintenance Records (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.

250 Hours maintenance: Clean the air filter, oil filter and clean the engine.

500 Hours maintenance: Change the air filter, oil filter and engine oil.

18000 Hours maintenance: General service of the generator, which maintenance team doesn't have enough spear part for the general service.

2.12 Present Engine Running Period: 5604 hours

2.13 Turbo Charger Installation Possibility: Presently there are one turbo is installed in this generator as depicted in the pictures.

DIESEL GENERATOR INSPECTION FORM
G3 Little SIP

3.0 SITE

3.1 GENERAL

- a. Yard Type (flat, sloped, stepped) : Flat

3.2 DRAINAGE

- a. Type of System (surface or closed): Closed

3.3 YARD SURFACING MATERIAL

- a. Material:

3.3.a.1 Type : Concrete

3.3.a.2 Size: (L x W x H) 40.2 x 8.5 x 0.1

3.4 SECURITY FENCE

- a. Height : N/A
- b. Fabric Material : N/A
- c. Vehicle Gates (itemize as listed below for each size gate):
- d. Size: N/A
- e. Quantity : N/A

DIESEL GENERATOR INSPECTION FORM

G3 Little SIP

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House:

This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

4.2 Generator House Ventilation System Description: Out door

4.3 EXTERNAL DIMENSIONS

- a. Length 6.5 m
- b. Width 2.2 m
- c. Clear Height 2.34m

4.4 SUPERSTRUCTURE

- 4.4.a Type (pre-engineered metal or concrete block): N/A
- 4.4.b Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM
G3 Little SIP

5 GROUNDING

5.1 GROUND CONNECTIONS

- a. Steel:
 - 5.1.a.1 Type Conductor: N/A
 - 5.1.a.2 Size: N/A
 - 5.1.a.2 Connector: N/A
- b. Equipment:
 - 5.1.b.1 Type Conductor: Copper conductor
 - 5.1.b.2 Size: N/A
 - 5.1.b.3 Connector: Yes
- c. Fence:
 - 5.1.c.1 Type Conductor: N/A
 - 5.1.c.2 Size: N/A
 - 5.1.c.3 Connector: N/A

6 RACEWAYS

6.1 Conduit: N/A

- a. Material
- b. Size _____ cm (_____ in.)

6.2 Duct Bank: N/A

- a. Size
 - 6.2.a.1 Material: _____
 - 6.2.a.2 Width _____ m (_____ ft)
 - 6.2.a.3 Depth _____ m (_____ ft)
 - 6.2.a.4 Size of conduits _____ cm (_____ in.)

6.3 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete)
Cast-in-place concrete
 - 6.3.a.1 Width _____ cm (_____ in.)
 - 6.3.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM

G3 Little SIP

7 CORROSION

7.1 CATHODIC PROTECTION SYSTEM: N/A

7.2 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8 DC SYSTEM

- a. Nominal Voltage 24 volts
- b. Battery:
 - 8.1.b.1 Cell type: Wet type battery
 - 8.1.b.2 Number of cells: 2cells
 - 8.1.b.3 Battery Charger (describe): N/A
 - 8.1.b.4 DC amps: N/A

9 CONTROL HOUSE

9.1 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

- a. Power line carrier
- b. Audio tone
- c. Carrier or audio tone on shield wire
- d. Microwave (analog, digital, or MAS): Mobile Cell phone
- e. Fiber optics
- f. Wire lines

10 Any Other Information: This generator has engine problem.

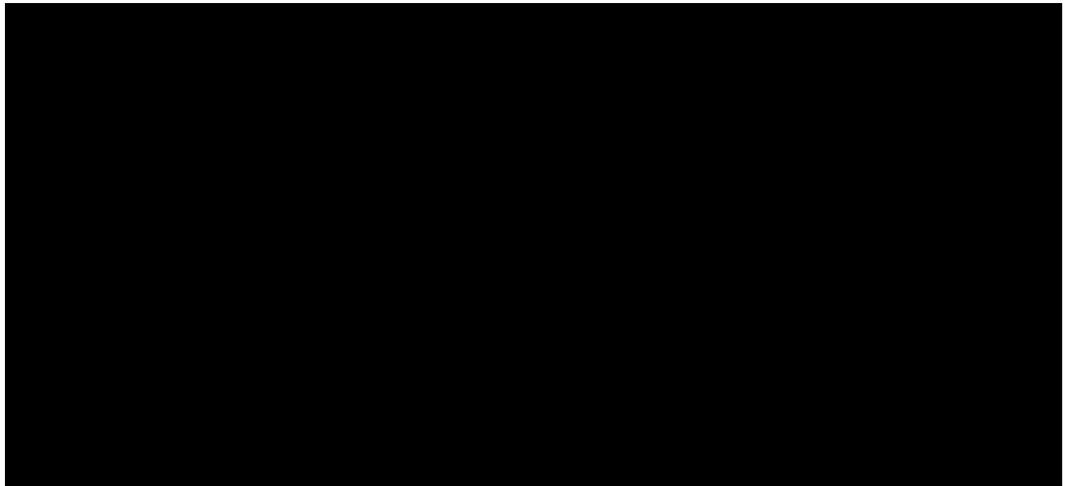
DIESEL GENERATOR INSPECTION FORM

G4 Little SIP

1.0 GENERAL

- 1.1 Inspection Date: 19/ 11 / 2014
- 1.2 Site Location : Shorandam
- 1.3 Site Description (Including total number of Gensets): The Small-SIP (Shorandam Industrial Park) Diesel power plant is located on Kandahar South East, there are 10 units each of 810kVA 3Ph, 50Hz and 0.8Pf.
- 1.4 Investigators :

1.5



- 1.6 Diesel Generator Number: 4
- 1.7 GPS Coordinate: 31.580031°, 65.823059°
- 1.8 Genset General Condition: Not Working
- 1.9 Genset age (Year of installation): 2012

DIESEL GENERATOR INSPECTION FORM

G4 Little SIP

2 GENERATORS DATA

2.1 Manufacturer : STAMFORD

2.2 Serial Number: 0221009/005

2.3 Model Number: A07B738871

2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 6 cylinders generator and feed by the diesel fuel and has 1 turbo system.

2.5 Output Power Rating 648kW, 810kVA

2.6 Operation Condition: Good Fair Not Operational

2.7 Condition Notes: This generator is not functional, has engine problem.

2.8 Operating Hours: 5550

2.9 Fuel Usage (Litters/hours): N/A

2.10 Typical Operation (Hours/day, continues, standby, load etc.): N/A

2.11 Maintenance Records (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.

250 Hours maintenance: Clean the air filter, oil filter and clean the engine.

500 Hours maintenance: Change the air filter, oil filter and engine oil.

18000 Hours maintenance: General service of the generator, which maintenance team doesn't have enough spear part for the general service.

2.12 Present Engine Running Period: 5550 hours

2.13 Turbo Charger Installation Possibility: Presently there are one turbo is installed in this generator as depicted in the pictures.

DIESEL GENERATOR INSPECTION FORM
G4 Little SIP

3.0 SITE

3.1 GENERAL

- a. Yard Type (flat, sloped, stepped) : Flat

3.2 DRAINAGE

- a. Type of System (surface or closed): Closed

3.3 YARD SURFACING MATERIAL

- a. Material:

3.3.a.1 Type : Concrete

3.3. a.2 Size: (L x W x H) 40.2x8.5x0.1

3.4 SECURITY FENCE

- a. Height : N/A
- b. Fabric Material : N/A
- c. Vehicle Gates (itemize as listed below for each size gate):
- d. Size: N/A
- e. Quantity : N/A

DIESEL GENERATOR INSPECTION FORM

G4 Little SIP

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House:

This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

4.2 Generator House Ventilation System Description: Out door

4.3 EXTERNAL DIMENSIONS

- a. Length 6.5 m
- b. Width 2.2 m
- c. Clear Height 2.34m

4.4 SUPERSTRUCTURE

- 4.4.a Type (pre-engineered metal or concrete block): N/A
- 4.4.b Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM
G4 Little SIP

5 GROUNDING

5.4 GROUND CONNECTIONS

5.4.a Steel:

5.4.a.1 Type Conductor: N/A

5.4.a.2 Size: N/A

5.1.a.2 Connector: N/A

5.4.b Equipment:

5.4.b.1 Type Conductor: Copper conductor

5.4.b.2 Size: N/A

5.4.b.3 Connector: Yes

5.4.c Fence:

5.4.c.1 Type Conductor: N/A

5.4.c.2 Size: N/A

5.4.c.3 Connector: N/A

6 RACEWAYS

6.4 Conduit: N/A

6.4.a Material

6.4.b Size _____ cm (_____ in.)

6.5 Duct Bank: N/A

6.5.a Size

6.5.a.1 Material: _____

6.5.a.2 Width _____ m (_____ ft)

6.5.a.3 Depth _____ m (_____ ft)

6.5.a.4 Size of conduits _____ cm (_____ in.)

6.6 Cable Trench

6.6.a Type (concrete block, cast-in-place concrete, or precast concrete)

Cast-in-place concrete

6.6.a.1 Width _____ cm (_____ in.)

6.6.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM

G4 Little SIP

7 CORROSION

7.4 CATHODIC PROTECTION SYSTEM: N/A

7.5 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8 DC SYSTEM

8.4.a Nominal Voltage 24 volts

8.4.b Battery:

8.4.b.1 Cell type: Wet type battery

8.4.b.2 Number of cells: 2cells

8.4.b.3 Battery Charger (describe): N/A

8.4.b.4 DC amps: N/A

9 CONTROL HOUSE

9.4 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

9.4.a Power line carrier

9.4.b Audio tone

9.4.c Carrier or audio tone on shield wire

9.4.d Microwave (analog, digital, or MAS): Mobile Cell phone

9.4.e Fiber optics

9.4.f Wire lines

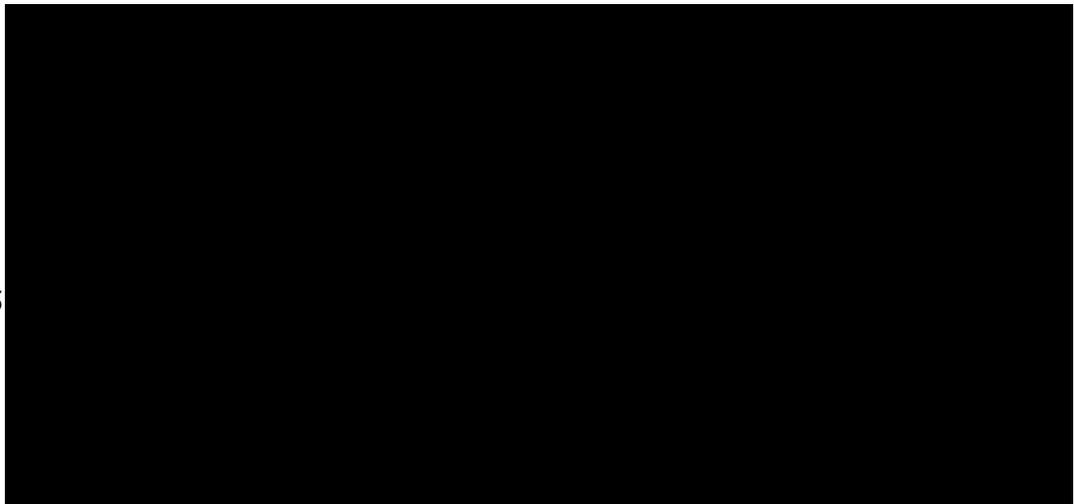
10 Any Other Information: This generator has engine problem.

DIESEL GENERATOR INSPECTION FORM

G5 Little SIP

1.0 GENERAL

- 1.1 Inspection Date: 19/ 11 / 2014
- 1.2 Site Location : Shorandam
- 1.3 Site Description (Including total number of Gensets): The Small-SIP (Shorandam Industrial Park) Diesel power plant is located on Kandahar South East, there are 10 units each of 810kVA 3Ph, 50Hz and 0.8Pf.
- 1.4 Investigators :



1.5

- 1.6 Diesel Generator Number: 5
- 1.7 GPS Coordinate: 31.580031°, 65.823059°
- 1.8 Genset General Condition: Not Working
- 1.9 Genset age (Year of installation): 2012

DIESEL GENERATOR INSPECTION FORM

G5 Little SIP

2 GENERATORS DATA

2.1 Manufacturer : STAMFORD

2.2 Serial Number: 0228291/009

2.3 Model Number: A07D789134

2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 6 cylinders generator and feed by the diesel fuel and has 1 turbo system.

2.5 Output Power Rating 648kW, 810kVA

2.6 Operation Condition: Good Fair Not Operational

2.7 Condition Notes: This generator is not functional, has engine problem.

2.8 Operating Hours: 4940

2.9 Fuel Usage (Litters/hours): N/A

2.10 Typical Operation (Hours/day, continues, standby, load etc.): N/A

2.11 Maintenance Records (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.

250 Hours maintenance: Clean the air filter, oil filter and clean the engine.

500 Hours maintenance: Change the air filter, oil filter and engine oil.

18000 Hours maintenance: General service of the generator, which maintenance team doesn't have enough spear part for the general service.

2.12 Present Engine Running Period: 4940 hours

2.13 Turbo Charger Installation Possibility: Presently there are one turbo is installed in this generator as depicted in the pictures.

DIESEL GENERATOR INSPECTION FORM

G5 Little SIP

3.0 SITE

3.1 GENERAL

- a. Yard Type (flat, sloped, stepped) : Flat

3.2 DRAINAGE

- a. Type of System (surface or closed): Closed

3.3 YARD SURFACING MATERIAL

- a. Material:

3.3.a.1 Type : Concrete

3.3.a.2 Size: (L x W x H) 40.2 x 8.5 x 0.1

3.4 SECURITY FENCE

- a. Height : N/A
- b. Fabric Material : N/A
- c. Vehicle Gates (itemize as listed below for each size gate):
- d. Size: N/A
- e. Quantity : N/A

DIESEL GENERATOR INSPECTION FORM

G5 Little SIP

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House:

This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

Generator House Ventilation System Description: Out door

4.2 EXTERNAL DIMENSIONS

- a. Length 6.5 m
- b. Width 2.2 m
- c. Clear Height 2.34m

4.3 SUPERSTRUCTURE

- a. Type (pre-engineered metal or concrete block): N/A
- b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM
G5 Little SIP

5 GROUNDING

5.3 GROUND CONNECTIONS

- a. Steel:
 - 5.3.a.1 Type Conductor: N/A
 - 5.3.a.2 Size: N/A
- b. Connector: N/A
- c. Equipment:
 - 5.3.c.1 Type Conductor: Copper conductor
 - 5.3.c.2 Size: N/A
 - 5.3.c.3 Connector: Yes
- d. Fence:
 - 5.3.d.1 Type Conductor: N/A
 - 5.3.d.2 Size: N/A
 - 5.3.d.3 Connector: N/A

6 RACEWAYS

6.3 Conduit: N/A

- a. Material
- b. Size _____ cm (_____ in.)

6.4 Duct Bank: N/A

- a. Size
 - 6.4.a.1 Material: _____
 - 6.4.a.2 Width _____ m (_____ ft)
 - 6.4.a.3 Depth _____ m (_____ ft)
 - 6.4.a.4 Size of conduits _____ cm (_____ in.)

6.5 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete)
Cast-in-place concrete
 - 6.5.a.1 Width _____ cm (_____ in.)
 - 6.5.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM

G5 Little SIP

7 CORROSION

7.3 CATHODIC PROTECTION SYSTEM: N/A

7.4 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8 DC SYSTEM

- a. Nominal Voltage 24 volts
- b. Battery:
 - 8.3.b.1 Cell type: Wet type battery
 - 8.3.b.2 Number of cells: 2cells
 - 8.3.b.3 Battery Charger (describe): N/A
 - 8.3.b.4 DC amps: N/A

9 CONTROL HOUSE

9.3 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

- a. Power line carrier
- b. Audio tone
- c. Carrier or audio tone on shield wire
- d. Microwave (analog, digital, or MAS): Mobile Cell phone
- e. Fiber optics
- f. Wire lines

10 Any Other Information: This generator has engine problem.

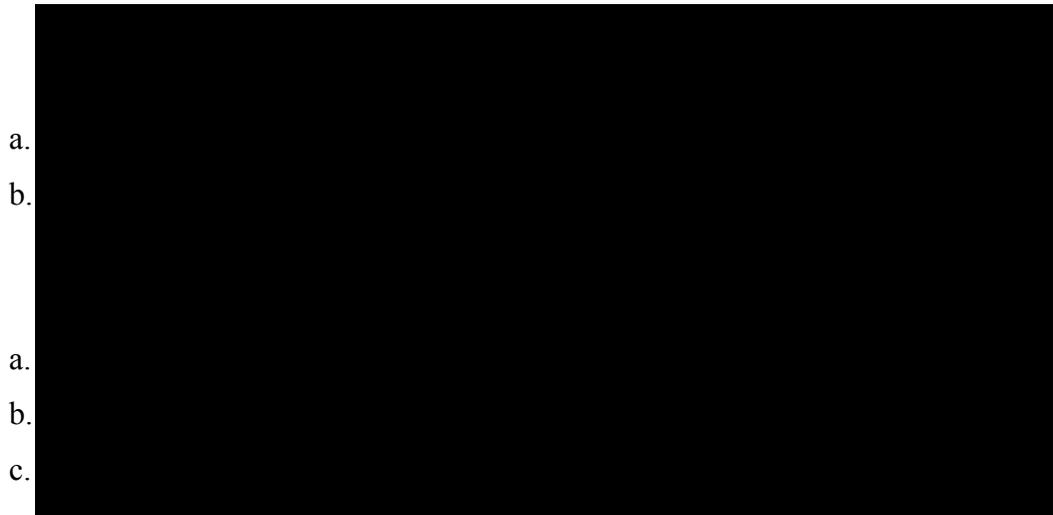
DIESEL GENERATOR INSPECTION FORM

G6 Little SIP

1.0 GENERAL

- 1.1 Inspection Date: 19 / 11 / 2014
- 1.2 Site Location : Shorandam
- 1.3 Site Description (Including total number of Gensets): The Small-SIP (Shorandam Industrial Park) Diesel power plant is located on Kandahar South East, there are 10 units each of 810kVA 3Ph, 50Hz and 0.8Pf.

1.4 Investigators :



- 1.6 Diesel Generator Number: 6
- 1.7 GPS Coordinate: 31.580031°, 65.823059°
- 1.8 Genset General Condition: Not Working
- 1.9 Genset age (Year of installation): 2012

DIESEL GENERATOR INSPECTION FORM

G6 Little SIP

2 GENERATORS DATA

2.1 Manufacturer : STAMFORD

2.2 Serial Number: 0221009/007

2.3 Model Number: A07B739985

2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 6 cylinders generator and feed by the diesel fuel and has 1 turbo system.

2.5 Output Power Rating 648kW, 810kVA

2.6 Operation Condition: Good Fair Not Operational

2.7 Condition Notes: This generator is not functional, has engine problem.

2.8 Operating Hours: 6021

2.9 Fuel Usage (Litters/hours): N/A

2.10 Typical Operation (Hours/day, continues, standby, load etc.): N/A

2.11 Maintenance Records (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.

250 Hours maintenance: Clean the air filter, oil filter and clean the engine.

500 Hours maintenance: Change the air filter, oil filter and engine oil.

18000 Hours maintenance: General service of the generator, which maintenance team doesn't have enough spear part for the general service.

2.12 Present Engine Running Period: 6021 hours

2.13 Turbo Charger Installation Possibility: Presently there are one turbo is installed in this generator as depicted in the pictures.

DIESEL GENERATOR INSPECTION FORM
G6 Little SIP

3.0 SITE

3.1 GENERAL

- a. Yard Type (flat, sloped, stepped) : Flat

3.2 DRAINAGE

- a. Type of System (surface or closed): Closed

3.3 YARD SURFACING MATERIAL

- a. Material:

3.3.a.1 Type : Concrete

3.3.a.2 Size: (L x W x H) 40.2 x 8.5 x 0.1

3.4 SECURITY FENCE

- a. Height : N/A
- b. Fabric Material : N/A
- c. Vehicle Gates (itemize as listed below for each size gate):
- d. Size: N/A
- e. Quantity : N/A

DIESEL GENERATOR INSPECTION FORM

G6 Little SIP

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House:

This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

4.2 Generator House Ventilation System Description: Out door

4.3 EXTERNAL DIMENSIONS

- a. Length 6.5 m
- b. Width 2.2 m
- c. Clear Height 2.34m

4.4 SUPERSTRUCTURE

- a. Type (pre-engineered metal or concrete block): N/A
- 4.4.b Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM
G6 Little SIP

5 GROUNDING

5.4 GROUND CONNECTIONS

- a. Steel:
 - 5.4.a.1 Type Conductor: N/A
 - 5.4.a.2 Size: N/A
- b. Connector: N/A
- c. Equipment:
 - 5.4.c.1 Type Conductor: Copper conductor
 - 5.4.c.2 Size: N/A
 - 5.4.c.3 Connector: Yes
- d. Fence:
 - 5.4.d.1 Type Conductor: N/A
 - 5.4.d.2 Size: N/A
 - 5.4.d.3 Connector: N/A

6 RACEWAYS

6.4 Conduit: N/A

- a. Material
- b. Size _____ cm (_____ in.)

6.5 Duct Bank: N/A

- a. Size
 - 6.5.a.1 Material: _____
 - 6.5.a.2 Width _____ m (_____ ft)
 - 6.5.a.3 Depth _____ m (_____ ft)
 - 6.5.a.4 Size of conduits _____ cm (_____ in.)

6.6 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete)

Cast-in-place concrete

- 6.6.a.1 Width _____ cm (_____ in.)
- 6.6.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM

G6 Little SIP

7 CORROSION

7.4 CATHODIC PROTECTION SYSTEM: N/A

7.5 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8 DC SYSTEM

- a. Nominal Voltage 24 volts
- b. Battery:
 - 8.4.b.1 Cell type: Wet type battery
 - 8.4.b.2 Number of cells: 2cells
 - 8.4.b.3 Battery Charger (describe): N/A
 - 8.4.b.4 DC amps: N/A

9 CONTROL HOUSE

9.4 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

- a. Power line carrier
- b. Audio tone
- c. Carrier or audio tone on shield wire
- d. Microwave (analog, digital, or MAS): Mobile Cell phone
- e. Fiber optics
- f. Wire lines

10 Any Other Information: This generator has engine problem.

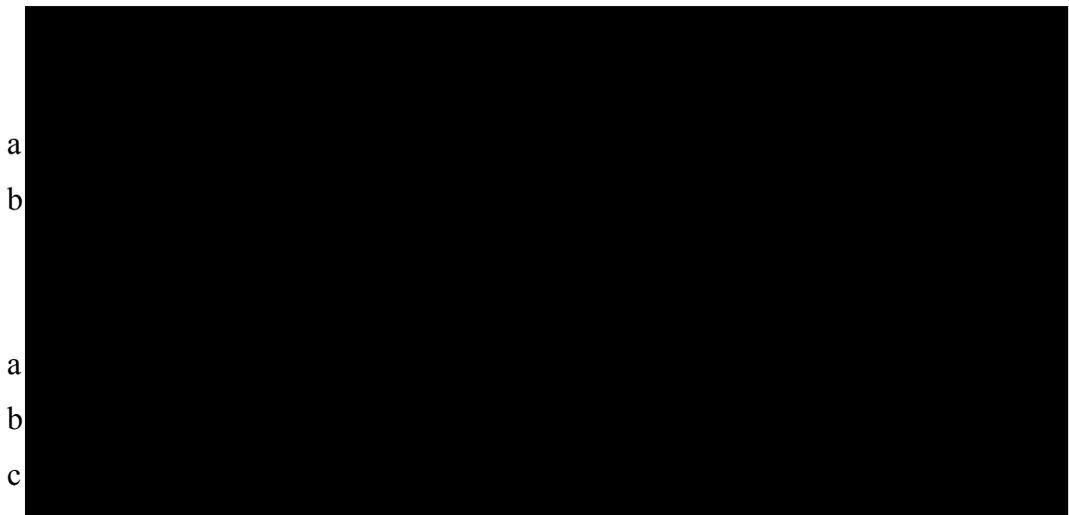
DIESEL GENERATOR INSPECTION FORM

G7 Little SIP

1.0 GENERAL

- 1.1 Inspection Date: 19 / 11 / 2014
- 1.2 Site Location : Shorandam
- 1.3 Site Description (Including total number of Gensets): The Small-SIP (Shorandam Industrial Park) Diesel power plant is located on Kandahar South East, there are 10 units each of 810kVA 3Ph, 50Hz and 0.8Pf.

1.4 Investigators :



- 1.6 Diesel Generator Number: 7
- 1.7 GPS Coordinate: 31.580031°, 65.823059°
- 1.8 Genset General Condition: Functional
- 1.9 Genset age (Year of installation): 2012

DIESEL GENERATOR INSPECTION FORM

G7 Little SIP

2 GENERATORS DATA

2.1 Manufacturer : STAMFORD

2.2 Serial Number: 0221296/004

2.3 Model Number: A07D784727

2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 6 cylinders generator and feed by the diesel fuel and has 1 turbo system.

2.5 Output Power Rating 648kW, 810kVA

2.6 Operation Condition: Good Fair Not Operational

2.7 Condition Notes: This generator is functional.

2.8 Operating Hours: 7104

2.9 Fuel Usage (Litters/hours): 185Litters/ Hour, according to the plant manager.

2.10 Typical Operation (Hours/day, continues, standby, load etc.): 24 Hours/Day

2.11 Maintenance Records (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.

250 Hours maintenance: Clean the air filter, oil filter and clean the engine.

500 Hours maintenance: Change the air filter, oil filter and engine oil.

18000 Hours maintenance: General service of the generator, which maintenance team doesn't have enough spear part for the general service.

2.12 Present Engine Running Period: 7104 hours

2.13 Turbo Charger Installation Possibility: Presently there are one turbo is installed in this generator as depicted in the pictures.

DIESEL GENERATOR INSPECTION FORM
G7 Little SIP

3.0 SITE

3.1 GENERAL

- a. Yard Type (flat, sloped, stepped) : Flat

3.2 DRAINAGE

- a. Type of System (surface or closed): Closed

3.3 YARD SURFACING MATERIAL

- a. Material:

3.3.a.1 Type : Concrete

3.3.a.2 Size: (L x W x H) 40.2 x 8.5 x 0.1

3.4 SECURITY FENCE

- a. Height : N/A
- b. Fabric Material : N/A
- c. Vehicle Gates (itemize as listed below for each size gate):
- d. Size: N/A
- e. Quantity : N/A

DIESEL GENERATOR INSPECTION FORM

G7 Little SIP

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House:

This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

Generator House Ventilation System Description: Out door

4.2 EXTERNAL DIMENSIONS

- a. Length 6.5 m
- b. Width 2.2 m
- c. Clear Height 2.34m

4.3 SUPERSTRUCTURE

- a. Type (pre-engineered metal or concrete block): N/A
- b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM
G7 Little SIP

5 GROUNDING

5.3 GROUND CONNECTIONS

- a. Steel:
 - 5.3.a.1 Type Conductor: N/A
 - 5.3.a.2 Size: N/A
- b. Connector: N/A
- c. Equipment:
 - 5.3.c.1 Type Conductor: Copper conductor
 - 5.3.c.2 Size: N/A
 - 5.3.c.3 Connector: Yes
- d. Fence:
 - 5.3.d.1 Type Conductor: N/A
 - 5.3.d.2 Size: N/A
 - 5.3.d.3 Connector: N/A

6 RACEWAYS

6.3 Conduit: N/A

- a. Material
- b. Size _____ cm (_____ in.)

6.4 Duct Bank: N/A

- a. Size
 - 6.4.a.1 Material: _____
 - 6.4.a.2 Width _____ m (_____ ft)
 - 6.4.a.3 Depth _____ m (_____ ft)
 - 6.4.a.4 Size of conduits _____ cm (_____ in.)

6.5 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete)
Cast-in-place concrete
 - 6.5.a.1 Width _____ cm (_____ in.)
 - 6.5.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM

G7 Little SIP

7 CORROSION

7.3 CATHODIC PROTECTION SYSTEM: N/A

7.4 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8 DC SYSTEM

- a. Nominal Voltage 24 volts
- b. Battery:
 - 8.3.b.1 Cell type: Wet type battery
 - 8.3.b.2 Number of cells: 2cells
 - 8.3.b.3 Battery Charger (describe): N/A
 - 8.3.b.4 DC amps: N/A

9 CONTROL HOUSE

9.3 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

- a. Power line carrier
- b. Audio tone
- c. Carrier or audio tone on shield wire
- d. Microwave (analog, digital, or MAS): Mobile Cell phone
- e. Fiber optics
- f. Wire lines

10 Any Other Information: Nil.

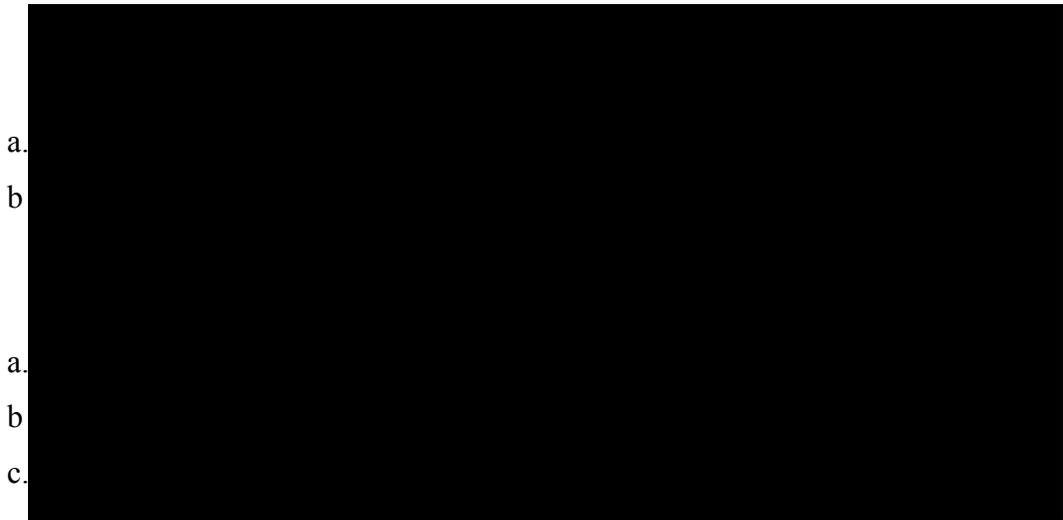
DIESEL GENERATOR INSPECTION FORM

G8 Little SIP

1.0 GENERAL

- 1.1 Inspection Date: 19/ 11 / 2014
- 1.2 Site Location : Shorandam
- 1.3 Site Description (Including total number of Gensets): The Small-SIP (Shorandam Industrial Park) Diesel power plant is located on Kandahar South East, there are 10 units each of 810kVA 3Ph, 50Hz and 0.8Pf.

1.4 Investigators :



- 1.6 Diesel Generator Number: 8
- 1.7 GPS Coordinate: 31.580031°, 65.823059°
- 1.8 Genset General Condition: Functional
- 1.9 Genset age (Year of installation): 2012

DIESEL GENERATOR INSPECTION FORM

G8 Little SIP

2 GENERATORS DATA

2.1 Manufacturer : STAMFORD

2.2 Serial Number: 0228291/005

2.3 Model Number: A07D785940

2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 6 cylinders generator and feed by the diesel fuel and has 1 turbo system.

2.5 Output Power Rating 648kW, 810kVA

2.6 Operation Condition: Good Fair Not Operational

2.7 Condition Notes: This generator is functional.

2.8 Operating Hours: 7212

2.9 Fuel Usage (Litters/hours): 185Litters/ Hour, according to the plant manager.

2.10 Typical Operation (Hours/day, continues, standby, load etc.): 24 Hours/Day

2.11 Maintenance Records (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.

250 Hours maintenance: Clean the air filter, oil filter and clean the engine.

500 Hours maintenance: Change the air filter, oil filter and engine oil.

18000 Hours maintenance: General service of the generator, which maintenance team doesn't have enough spear part for the general service.

2.12 Present Engine Running Period: 7212 hours

2.13 Turbo Charger Installation Possibility: Presently there are one turbo is installed in this generator as depicted in the pictures.

DIESEL GENERATOR INSPECTION FORM
G8 Little SIP

3.0 SITE

3.1 GENERAL

- a. Yard Type (flat, sloped, stepped) : Flat

3.2 DRAINAGE

- a. Type of System (surface or closed): Closed

3.3 YARD SURFACING MATERIAL

- a. Material:

3.3.a.1 Type : Concrete

3.3.a.2 Size: (L x W x H) 40.2 x 8.5 x 0.1

3.4 SECURITY FENCE

- a. Height : N/A
- b. Fabric Material : N/A
- c. Vehicle Gates (itemize as listed below for each size gate):
- d. Size: N/A
- e. Quantity : N/A

DIESEL GENERATOR INSPECTION FORM

G8 Little SIP

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House:

This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

Generator House Ventilation System Description: Out door

DIMENSIONS

- a. Length 6.5 m
- b. Width 2.2 m
- c. Clear Height 2.34m

4.2 SUPERSTRUCTURE

- a. Type (pre-engineered metal or concrete block): N/A
- b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM
G8 Little SIP

5.0 GROUNDING

5.1 GROUND CONNECTIONS

- a. Steel:
 - 5.1.a.1 Type Conductor: N/A
 - 5.1.a.2 Size: N/A
- b. Connector: N/A
- c. Equipment:
 - 5.1.c.1 Type Conductor: Copper conductor
 - 5.1.c.2 Size: N/A
 - 5.1.c.3 Connector: Yes
- d. Fence:
 - 5.1.d.1 Type Conductor: N/A
 - 5.1.d.2 Size: N/A
 - 5.1.d.3 Connector: N/A

6.0 RACEWAYS

6.1 Conduit: N/A

- a. Material
- b. Size _____ cm (_____ in.)

6.2 Duct Bank: N/A

- a. Size
 - 6.2.a.1 Material: _____
 - 6.2.a.2 Width _____ m (_____ ft)
 - 6.2.a.3 Depth _____ m (_____ ft)
 - 6.2.a.4 Size of conduits _____ cm (_____ in.)

6.3 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete)
Cast-in-place concrete
 - 6.3.a.1 Width _____ cm (_____ in.)
 - 6.3.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM

G8 Little SIP

7.0 CORROSION

7.1 CATHODIC PROTECTION SYSTEM: N/A

7.2 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8.0 DC SYSTEM

- a. Nominal Voltage 24 volts
- b. Battery:
 - 8.1.b.1 Cell type: Wet type battery
 - 8.1.b.2 Number of cells: 2cells
 - 8.1.b.3 Battery Charger (describe): N/A
 - 8.1.b.4 DC amps: N/A

9.0 CONTROL HOUSE

9.1 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

- a. Power line carrier
- b. Audio tone
- c. Carrier or audio tone on shield wire
- d. Microwave (analog, digital, or MAS): Mobile Cell phone
- e. Fiber optics
- f. Wire lines

10.0 Any Other Information: Nil.

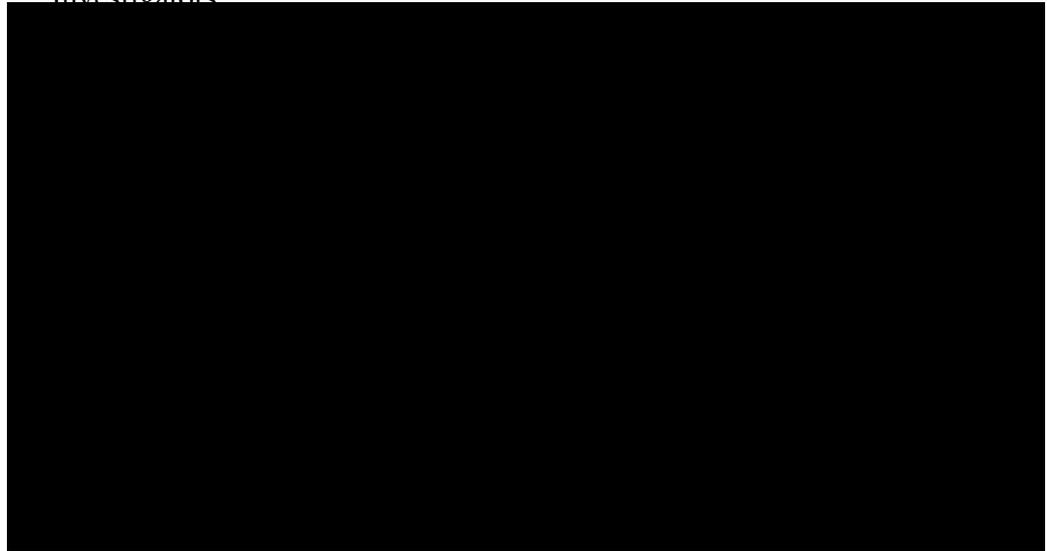
DIESEL GENERATOR INSPECTION FORM

G9 Little SIP

1.0 GENERAL

- 1.1 Inspection Date: 19 / 11 / 2014
- 1.2 Site Location : Shorandam
- 1.3 Site Description (Including total number of Gensets): The Small-SIP (Shorandam Industrial Park) Diesel power plant is located on Kandahar South East, there are 10 units each of 810kVA 3Ph, 50Hz and 0.8Pf.

1.4 Investigators :



1.5

- 1.6 Diesel Generator Number: 9
- 1.7 GPS Coordinate: 31.580031°, 65.823059°
- 1.8 Genset General Condition: Not Working
- 1.9 Genset age (Year of installation): 2012

DIESEL GENERATOR INSPECTION FORM

G9 Little SIP

2 GENERATORS DATA

2.1 Manufacturer : STAMFORD

2.2 Serial Number: 0221067/001

2.3 Model Number: A07A717409

2.4 Basic Description (Number of cylinders, turbo, injection type, fuel rating and etc): This is a 6 cylinders generator and feed by the diesel fuel and has 1 turbo system.

2.5 Output Power Rating 648kW, 810kVA

2.6 Operation Condition: Good Fair Not Operational

2.7 Condition Notes: This generator is not functional, has engine problem.

2.8 Operating Hours: 5811

2.9 Fuel Usage (Litters/hours): N/A

2.10 Typical Operation (Hours/day, continues, standby, load etc.): N/A

2.11 Maintenance Records (how, how often, what): This power plant have three type maintenance, 250 Hours, 500 Hours and 18000 Hours maintenance.

250 Hours maintenance: Clean the air filter, oil filter and clean the engine.

500 Hours maintenance: Change the air filter, oil filter and engine oil.

18000 Hours maintenance: General service of the generator, which maintenance team doesn't have enough spear part for the general service.

2.12 Present Engine Running Period: 5811 hours

2.13 Turbo Charger Installation Possibility: Presently there are one turbo is installed in this generator as depicted in the pictures.

DIESEL GENERATOR INSPECTION FORM
G9 Little SIP

3.0 SITE

3.1 GENERAL

a. Yard Type (flat, sloped, stepped) : Flat

3.2 DRAINAGE

a. Type of System (surface or closed): Closed

3.3 YARD SURFACING MATERIAL

3.3.1 Material:

3.3.a.1 Type : Concrete

3.3.a.2 Size: (L x W x H) 40.2 x 8.5 x 0.1

3.4 SECURITY FENCE

3.4.1 Height : N/A

3.4.2 Fabric Material : N/A

3.4.3 Vehicle Gates (itemize as listed below for each size gate):

3.4.4 Size: N/A

3.4.5 Quantity : N/A

DIESEL GENERATOR INSPECTION FORM

G9 Little SIP

4.0 GENERATORS STRUCTURES

4.1 Description of Generator House:

This generator installed outdoors on concrete reinforces pads. This generator has sound proof and weather proof cover.

4.2 Generator House Ventilation System Description: Out door

4.3 EXTERNAL DIMENSIONS

a. Length 6.5 m

4.3.1 Width 2.2 m

b. Clear Height 2.34m

4.4 SUPERSTRUCTURE

a. Type (pre-engineered metal or concrete block): N/A

b. Roof Type (precast, prestressed concrete panels, or steel joists and steel decks): N/A

DIESEL GENERATOR INSPECTION FORM
G9 Little SIP

5 GROUNDING

5.3 GROUND CONNECTIONS

- a. Steel:
 - 5.3.a.1 Type Conductor: N/A
 - 5.3.a.2 Size: N/A
- b. Connector: N/A
- c. Equipment:
 - 5.3.c.1 Type Conductor: Copper conductor
 - 5.3.c.2 Size: N/A
 - 5.3.c.3 Connector: Yes
- d. Fence:
 - 5.3.d.1 Type Conductor: N/A
 - 5.3.d.2 Size: N/A
 - 5.3.d.3 Connector: N/A

6 RACEWAYS

6.3 Conduit: N/A

- a. Material
- b. Size _____ cm (_____ in.)

6.4 Duct Bank: N/A

- a. Size
 - 6.4.a.1 Material: _____
 - 6.4.a.2 Width _____ m (_____ ft)
 - 6.4.a.3 Depth _____ m (_____ ft)
 - 6.4.a.4 Size of conduits _____ cm (_____ in.)

6.5 Cable Trench

- a. Type (concrete block, cast-in-place concrete, or precast concrete)
Cast-in-place concrete
 - 6.5.a.1 Width _____ cm (_____ in.)
 - 6.5.a.2 Depth _____ cm (_____ in.)

DIESEL GENERATOR INSPECTION FORM

G9 Little SIP

7 CORROSION

7.3 CATHODIC PROTECTION SYSTEM: N/A

7.4 Basic Description of Protection System (if any): This generator is installed in weather proof enclosure.

8 DC SYSTEM

a. Nominal Voltage 24 volts

b. Battery:

8.3.b.1 Cell type: Wet type battery

8.3.b.2 Number of cells: 2cells

8.3.b.3 Battery Charger (describe): N/A

8.3.b.4 DC amps: N/A

9 CONTROL HOUSE

9.3 COMMUNICATIONS TECHNOLOGY

Select a communications technology based on the parameters defined above:

a. Power line carrier

b. Audio tone

c. Carrier or audio tone on shield wire

d. Microwave (analog, digital, or MAS): Mobile Cell phone

e. Fiber optics

f. Wire lines

10 Any Other Information: This generator has engine problem.

Generator 1 Little SIP



Generator 10 Little SIP



Generator 10 Little SIP



Generator 2 Little SIP



Generator 2 Little SIP



Generator 3 Little SIP



Generator 3 Little SIP



Generator 4 Little SIP



Generator 4 Little SIP



Generator 5 Little SIP



Generator 5 Little SIP



Generator 6 Little SIP



Generator 6 Little SIP



Generator 7 Little SIP



Generator 7 Little SIP



Generator 8 Little SIP



Generator 8 Little SIP



Generator 9 Little SIP



Generator 9 Little SIP



APPENDIX D
DATA SUPPORT DOCUMENTS

Approximate Fuel Consumption Chart

This chart approximates the fuel consumption of a diesel generator based on the size of the generator and the load at which the generator is operating at. Please note that this table is intended to be used as an estimate of how much fuel a generator uses during operation and is not an exact representation due to various factors that can increase or decrease the amount of fuel consumed.

Generator Size (kW)	1/4 Load (gal/hr)	1/2 Load (gal/hr)	3/4 Load (gal/hr)	Full Load (gal/hr)
20	0.6	0.9	1.3	1.6
30	1.3	1.8	2.4	2.9
40	1.6	2.3	3.2	4.0
60	1.8	2.9	3.8	4.8
75	2.4	3.4	4.6	6.1
100	2.6	4.1	5.8	7.4
125	3.1	5.0	7.1	9.1
135	3.3	5.4	7.6	9.8
150	3.6	5.9	8.4	10.9
175	4.1	6.8	9.7	12.7
200	4.7	7.7	11.0	14.4
230	5.3	8.8	12.5	16.6
250	5.7	9.5	13.6	18.0
300	6.8	11.3	16.1	21.5
350	7.9	13.1	18.7	25.1
400	8.9	14.9	21.3	28.6
500	11.0	18.5	26.4	35.7
600	13.2	22.0	31.5	42.8
750	16.3	27.4	39.3	53.4
1000	21.6	36.4	52.1	71.1
1250	26.9	45.3	65.0	88.8
1500	32.2	54.3	77.8	106.5
1750	37.5	63.2	90.7	124.2
2000	42.8	72.2	103.5	141.9
2250	48.1	81.1	116.4	159.6



MEETING MINUTES

SUBJECT: Discussion on Energy Recovery Systems

MEETING DATE: January 27, 2015 **LOCATION:** Conf. Rm/WebEx Conf. Call

PROJECT NAME: Kandahar Area Diesel Optimization **PROJECT #** 134637-LT 83 AMD 2

PREPARED BY: [REDACTED]

TO: See table below

ATTENDEES:

NAME	ORGANIZATION		NAME	ORGANIZATION		NAME	ORGANIZATION	
Ron Cooper	POWER	<input checked="" type="checkbox"/>	Mark McMannis	POWER	<input checked="" type="checkbox"/>	Christopher Poncelet	Bowman Power	<input checked="" type="checkbox"/>
In Attendance		<input checked="" type="checkbox"/>						

AGENDA ITEMS:

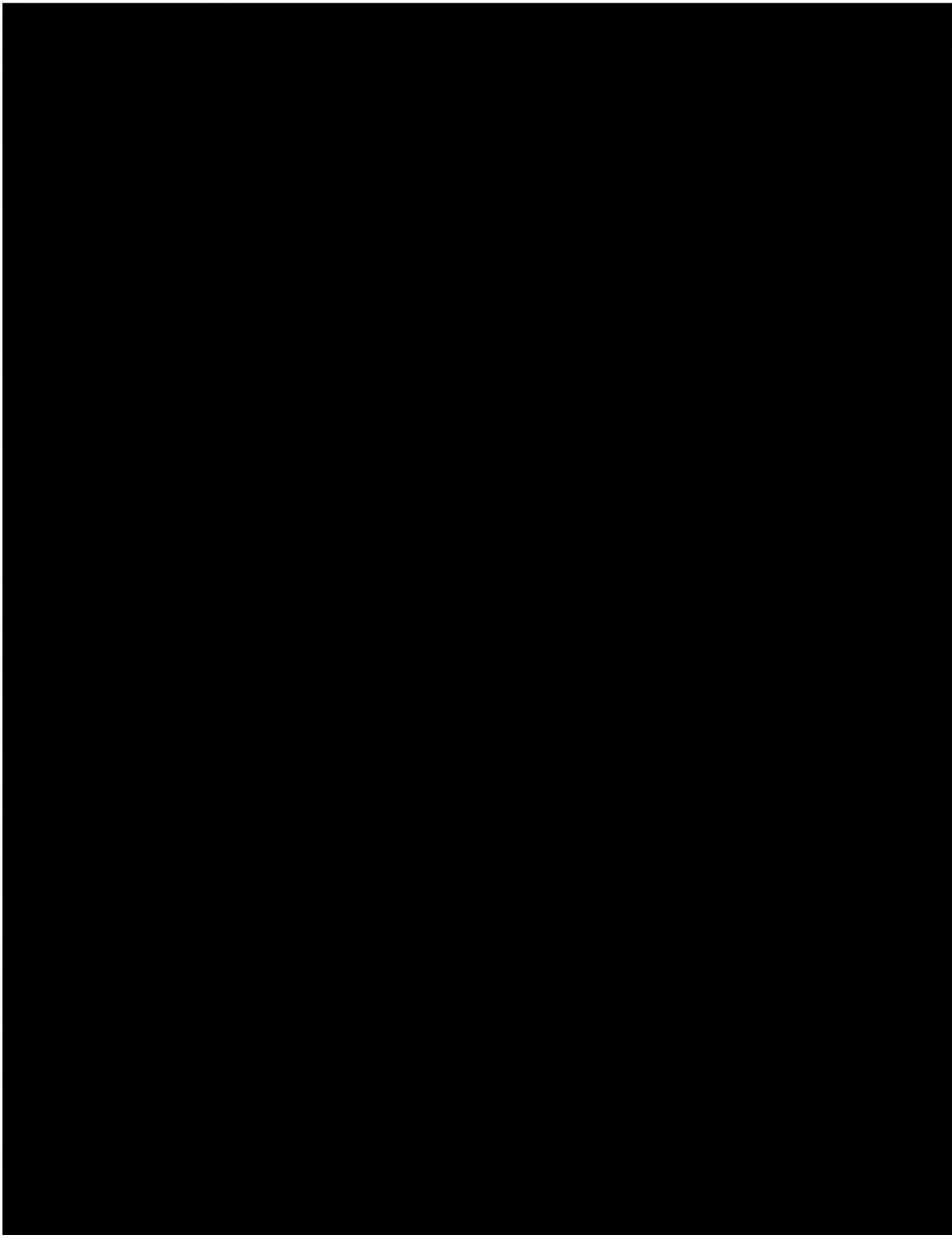
MEETING PURPOSE:

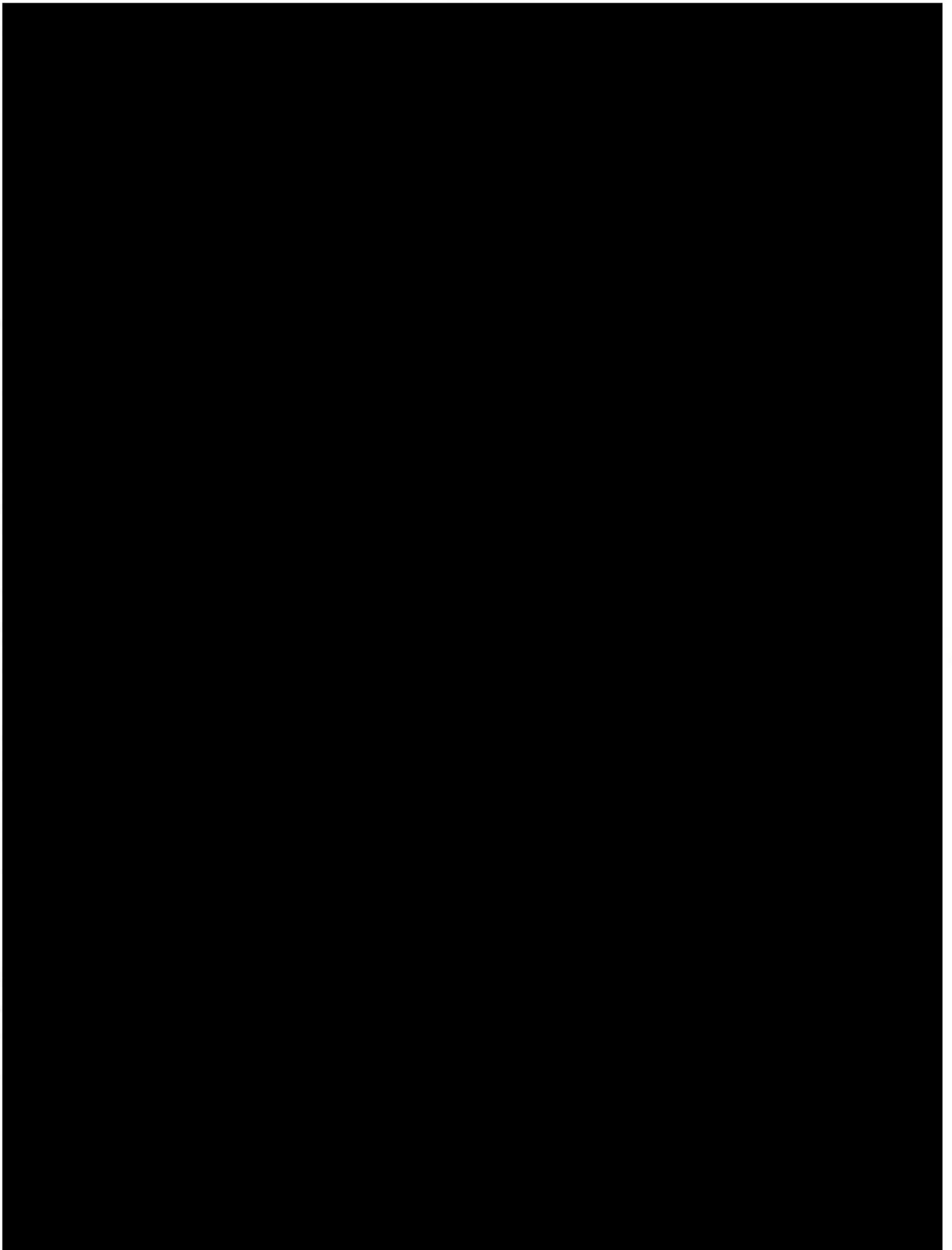
Next under are a series of questions posed to [REDACTED] (Bowman Power Representative) UK supplier of Energy Recovery Systems. Information provided in the aforementioned questions was used in the analysis of LT83AMD 2 Diesel Enhancement Study.

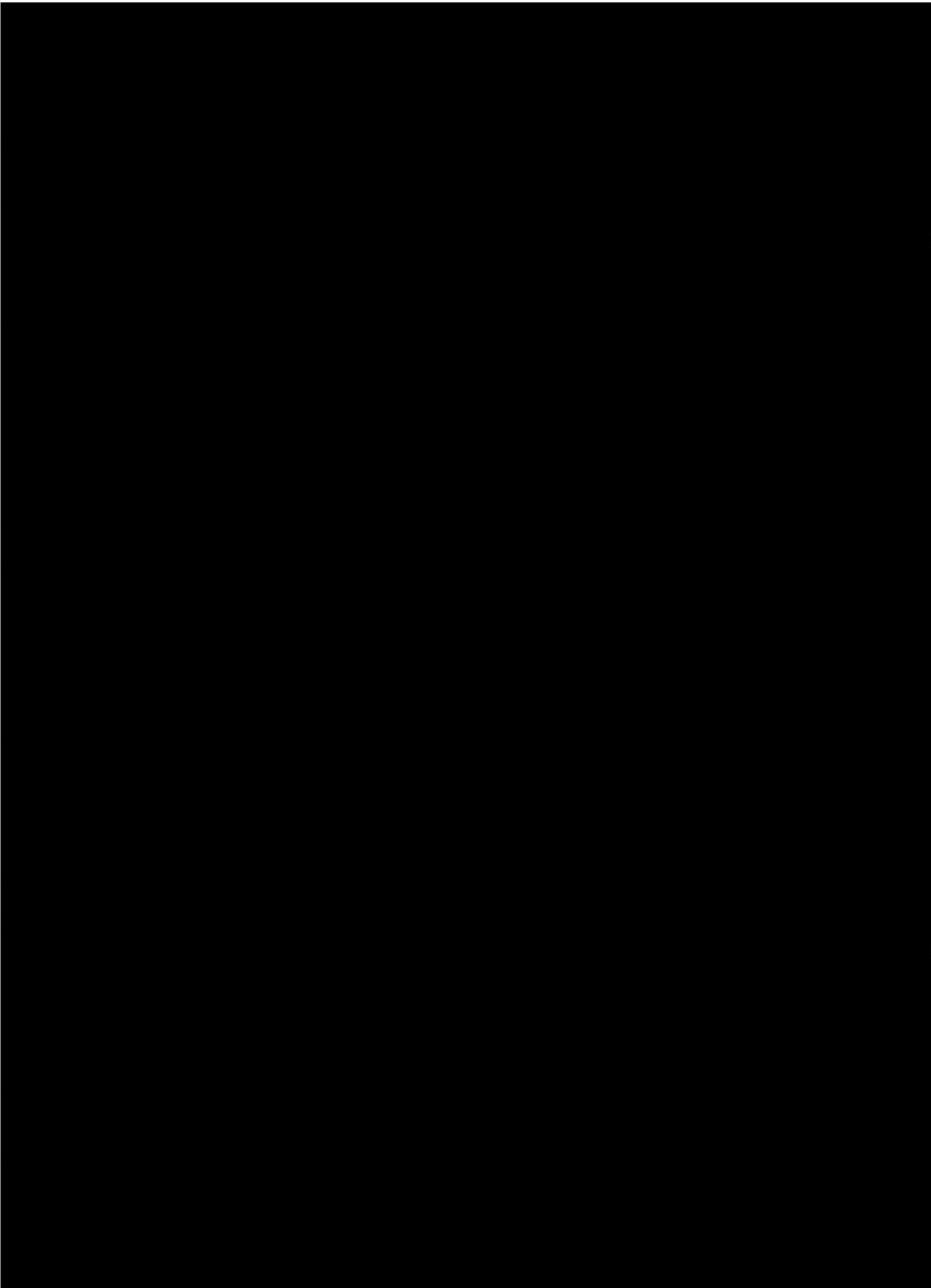
Q & A

- Q1:** Does Bowman make an ERS for a CAT 3516B?
A1: We have applied our systems to CAT 3516TA, so would not anticipate a problem.
- Q2:** What level of fuel savings were recorded on above?
A2: Just over 6.5%, net.
- Q3:** Our DGs are installed in tight enclosures. Would your ERS fit?
A3: Suggest best approach would be to build entire ERS in separate enclosure. Then field mount the system on top of DG enclosures, intersecting the exhaust system. This eliminates all field assembly efforts related to the ERS components.
- Q4:** What is largest system you offer?
A4: 120kW of energy recovered on a DG producing 1080kW.

- Q5:** Is the 1080kW a limit of Diesel power?
- A5:** *Our current designs are limited to the typical exhaust flow of a 1080kW, 50Hz engine. We are working on larger units, but are not expected in next year or so.*
- Q6:** Our engines are rated to 1600kW. So, are you saying your ERS would limit them to 1080kW?
- A6:** *In a normal application, yes. However, we do offer an automatic exhaust bypass valve option which allows operation to 1600kW. That option runs around \$35,000.*
- Q7:** How does the ERS interface with existing 400V power system?
- A7:** *Typically, the installation requires additional electrical cables from our ERS power cabinets to the generator set. Cables are connected to existing outgoing bus tabs at generator. No additional breakers or switchgear are required for concepts which are used mainly to increase efficiency, not total power.*
- Q8:** Does Bowman work in Afghanistan?
- A8:** *Basically, no. We can team with local companies to provide installation & service, by training them early in project, either here (England) or third country.*







er

ay

Installation / CAT 3516



'Host' Engine Before Installation



Bowman Hardware (for 2 Engines)



Turbochargers removed



TG Mounting Frame Goes On



TG Oil System



Power Electronics



Control Electronics



TGs on Engine Inside Container



Generating!



Installation & Commissioning Complete

Installation / CAT 3516



- Performance proven on reference site:
 - 6.5% reduction in bsfc @ 1250kWe
 - System fully integrated within original genset container (40')
 - Following detailed design of integration parts and integration proving on 1st system, installation takes ~1wk



APPENDIX E
PROJECT PRICING SPREADSHEETS

*Please note that Pricing Sheets do not itemize future Diesel Generator rebuild cost.
Only costs incurred at the start of the plan are listed.

General Instructions & Notes for Bidding Sheets

Form Operating Instructions

- 1 The Bidder shall supply all data shown in **blue cells**. Bidder inputs are required on Bidder Data, ERS (each), **and** ERS Summary work sheets.
- 2 **Only blue cells may be modified. All other cells are locked.**
- 3 Green cells are title & information only; yellow are automatic calculations and do not require or allow Bidder input.
- 4 A general description of line item can be obtained by hovering over respective line item Description cell. These descriptions can also be found in the Glossary of Line Item by Schedule/Item reference.
- 5 After all data is entered & checked, please print the Bidder Data, Cover Letter, ERS and Bid Summary sheets. The authorized signatory shall sign & place bidder seal at the indicated location on all sheets. Include all these sheets as part of your official Bid Package.

Form Notes

- 1 All bids **MUST** be submitted via these forms. Other methods shall be considered as non-complying with bidding instructions and shall therefore be rejected. Include all sheets in printed form in bid submittal.
- 2 After completing and printing the bids' forms, they must be **signed and sealed** by the authorized person of the bidding company at the appropriate locations displayed on these forms for all portions of the project. Once the the bids' forms have been signed, they will serve as an official record for the bids.
- 3 The **Line Item descriptions are shown for clarification only**. They are **not intended to be an all inclusive description of project work**. The Bidder shall ensure that all material and systems are supplied to provide a complete functional energy recovery system.
- 4 The ERS sheet covers all work to build a complete ERS.
- 5 All quantities include all material, shipping, storage, testing, and labor to provide a complete working component.

Base Data Sheet of Contractor & Project Information

Employer Data	Project Name	Energy Recovery Systems for Kandahar Diesel Generators
	DPP #1 Name	Bagh-e-Pol
	DPP #2 Name	Breshna Kot
	DPP #3 Name	SIP
	DABS Address Information	Da Afghanistan Breshna Sherkat (DABS) Head Quarters Chaman Houzouri Head Office Building, 2nd Floor, PMO Office Kabul, Afghanistan
	DABS Project Reference Number	
	Bid Closing Date	
Bid Closing Time		
Bidder Data	Name of Bidding Company	
	ICB Number	
	Invitation for Bidder Number	
	Date of Bid	
	Name of Authorized Signatory	
	Title of Authorized Signatory	
Bidder Statement	We have paid, or will pay the following commissions, gratuities, or fees with respect to the direct selection process or execution of the Contract:	
	Name of Recipient #1**	
	Address	
	Reason	
	Amount	
	Name of Recipient #2**	
	Address	
	Reason	
	Amount	

** If none has been paid or is to be paid, indicate "None" in Name.

I hereby certify that the above information is correct.

SEAL

Letter of Price Schedule

Date:

ICB Number

Invitation for Bidder No.

Da Afghanistan Breshna Sherkat (DABS) Head Quarters
Chaman Houzouri
Head Office Building, 2nd Floor, PMO Office
Kabul, Afghanistan

We, the undersigned, declare that:

- (a) We have examined and have no reservations to the Bidding Document including Addenda issued in accordance with Instructions to Bidder (ITB)8;
- (b) We offer to design, manufacture, test, deliver, install, pre-commission and commission in conformity with the Proposal Document the following Plant and Services: The Design, Supply, installation, testing, commissioning, and handing over of a turn-key Procurement of Plant – Energy Recovery Systems for Kandahar Diesel Generators. The turn key project includes also the mine clearing activities in the project area and the conformance with a Land Acquisition & Resettlement Plan (LARP) of the Employer.
- (c) The total price of our Bid, excluding any discounts offered in item (d) below is the sum of:
\$0.00
- (d) The discounts offered and the methodology for their application are:
Discount Offered: \$0.00
- (e) Our Bid shall be valid for a period of one hundred eighty (180) days from the date fixed for the submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;
- (f) If our Bid is accepted, we commit to obtain a performance security in accordance with the SCC of the Bidding Document;

(g) We have paid, or will pay the following commissions, gratuities, or fees with respect to the direct selection process or execution of the Contract: **

	<u>Name of Recipient</u>	<u>Address</u>	<u>Reason</u>	<u>Amount</u>
#1	0	0	0	\$0.00
#2	0	0	0	\$0.00

(h) We understand that this Bid, together with your written acceptance thereof included in your notification of award, shall be basis for the Negotiation of Contract and the Notice of Award of Contract on basis of the negotiated Contract Price shall constitute a binding contract between us, until a formal contract is prepared and executed; and

(i) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive.

(j) We agree to permit ADB or its representative to inspect our accounts and records and other documents relating to the Bid submission and to have them audited by auditors appointed by the Bank.

Name:

In the capacity of

Signed _____

Duly authorized to sign the Proposal for and on behalf of

Date

Da Afghanistan Breshna Sherkat (DABS)
Islamic Republic of Afghanistan
Pricing schedule

Design, Procure, Construct, Test and Commission an ERS at Breshna Kot					
Schedule No. 1					
Breshna Kot DPP: Supply of Major Plant and Equipment					
Item No.	Description	Units	QTY	Unit Price	Amount
1.1	Supply of Energy Recovery System Components	EA	4		\$0.00
1.2	Supply of DG Modification Parts	EA	4		\$0.00
1.3	Supply of Rebuild Parts for Existing Plant DG	EA	0		\$0.00
1.4	Supply of Materials for Exchange of DG with Spare DG	EA	0		\$0.00
				Shipping, Handling & Inland Transportation	
Schedule No. 1 Total					\$0.00
Schedule No. 2					
Breshna Kot DPP: Supply of Electrical Plant and Equipment					
Item No.	Description	Units	QTY	Unit Price	Amount
2.1	Supply of 400 Volt Electrical Interface Power Equipment	EA	4		\$0.00
2.2	Supply of Electrical Interface Control Equipment	EA	4		\$0.00
				Shipping, Handling & Inland Transportation	
Schedule No. 2 Total					\$0.00
Schedule No. 3					
Breshna Kot DPP: Mandatory Spare Parts					
Item No.	Description	Units	QTY	Unit Price	Amount
3.1	Protection System	LS	1		\$0.00
3.2	400 Volt Power Equipment	LS	1		\$0.00
3.3	Control System	LS	1		\$0.00
3.4	Cooling System	LS	1		\$0.00
3.5	Engine/PMG System	LS	1		\$0.00
				Shipping, Handling & Inland Transportation	
Schedule No. 3 Total					\$0.00

ICB No.:

OFFER DATE:

SEAL

BIDDER COMPANY:

AUTHORIZED SIGNATORY

Da Afghanistan Breshna Sherkat (DABS)
Islamic Republic of Afghanistan
Pricing schedule

Design, Procure, Construct, Test and Commission an ERS at Breshna Kot					
Schedule No. 4					
Breshna Kot DPP: Standard Tools					
Item No.	Description	Units	QTY	Unit Price	Amount
4.1	ERS Maintenance Tools & Appliances	LS	1		\$0.00
4.2	Test Equipment	LS	1		\$0.00
				Shipping, Handling & Inland Transportation	
Schedule No. 4 Total					\$0.00
Schedule No. 5					
Breshna Kot DPP: Design, Drawings and Documentation					
Item No.	Description	Units	QTY	Unit Price	Amount
5.1	Structural Design And General Arrangement Drawings	LS	1		\$0.00
5.2	Site Electrical Modifications Design Drawings	LS	1		\$0.00
5.3	Control Circuits & Wiring Drawings	LS	1		\$0.00
5.4	General Construction Drawings	LS	1		\$0.00
5.5	As Built Drawings	LS	1		\$0.00
5.6	Maintenance Manual And Completion Report	LS	1		\$0.00
				Shipping, Handling & Inland Transportation	
Schedule No. 5 Total					\$0.00

ICB No.:
OFFER DATE:
SEAL

BIDDER COMPANY:
AUTHORIZED SIGNATORY

Da Afghanistan Breshna Sherkat (DABS)
Islamic Republic of Afghanistan
Pricing schedule

Design, Procure, Construct, Test and Commission an ERS at Breshna Kot					
Schedule No. 6					
Breshna Kot DPP: Installation and Other Charges					
Item No.	Description	Units	QTY	Unit Price	Amount
6.1	Project Management	LS	1		\$0.00
6.2	Project Reporting	LS	1		\$0.00
6.3	Project Insurance	LS	1		\$0.00
6.4	Installation of Energy Recovery System Components	EA	4		\$0.00
6.5	Installation of DG Modification Parts	EA	4		\$0.00
6.6	Installation of Rebuild Parts for Existing Plant DG	EA	0		\$0.00
6.7	Installation of Materials for Exchange of DG with Spare Unit	EA	0		\$0.00
6.8	Relocation of Existing Diesel Generator	EA	0		\$0.00
6.9	Installation of 400 Volt Electrical Interface Power Equipment	EA	4		\$0.00
6.10	Installation of Electrical Interface Control Equipment	EA	4		\$0.00
6.11	Pre-Design Test	EA	0		\$0.00
6.12	Testing and Commissioning	EA	4		\$0.00
				Shipping, Handling & Inland Transportation	
				Schedule No. 6 Total	\$0.00
Schedule No. 7					
Breshna Kot DPP: Transfer of Knowledge					
Item No.	Description	Units	QTY	Unit Price	Amount
7.1	Training of Operation & Maintenance Management Staff	LS	1		\$0.00
7.2	On-Site Training During Construction and Commissioning	LS	1		\$0.00
7.3	Training of Operation & Maintenance General Staff	LS	1		\$0.00
				Shipping, Handling & Inland Transportation	
				Schedule No. 7 Total	\$0.00
				Breshna Kot Total	\$0.00

ICB No.:
OFFER DATE:
SEAL

BIDDER COMPANY:
AUTHORIZED SIGNATORY

Da Afghanistan Breshna Sherkat (DABS)
Islamic Republic of Afghanistan
Pricing schedule

Design, Procure, Construct, Test and Commission an ERS at Bagh-e-Pol					
Schedule No. 1					
Bagh-e-Pol DPP: Supply of Major Plant and Equipment					
Item No.	Description	Units	QTY	Unit Price	Amount
1.1	Supply of Energy Recovery System Components	EA	4		\$0.00
1.2	Supply of DG Modification Parts	EA	4		\$0.00
1.3	Supply of Rebuild Parts for Existing Plant DG	EA	2		\$0.00
1.4	Supply of Materials for Exchange of DG with Spare DG	EA	2		\$0.00
				Shipping, Handling & Inland Transportation	
				Schedule No. 1 Total	
				\$0.00	
Schedule No. 2					
Bagh-e-Pol DPP: Supply of Electrical Plant and Equipment					
Item No.	Description	Units	QTY	Unit Price	Amount
2.1	Supply of 400 Volt Electrical Interface Power Equipment	EA	4		\$0.00
2.2	Supply of Electrical Interface Control Equipment	EA	4		\$0.00
				Shipping, Handling & Inland Transportation	
				Schedule No. 2 Total	
				\$0.00	
Schedule No. 3					
Bagh-e-Pol DPP: Mandatory Spare Parts					
Item No.	Description	Units	QTY	Unit Price	Amount
3.1	Protection System	LS	1		\$0.00
3.2	400 Volt Power Equipment	LS	1		\$0.00
3.3	Control System	LS	1		\$0.00
3.4	Cooling System	LS	1		\$0.00
3.5	Engine/PMG System	LS	1		\$0.00
				Shipping, Handling & Inland Transportation	
				Schedule No. 3 Total	
				\$0.00	

ICB No.:
OFFER DATE:
SEAL

BIDDER COMPANY:
AUTHORIZED SIGNATORY

Da Afghanistan Breshna Sherkat (DABS)
Islamic Republic of Afghanistan
Pricing schedule

Design, Procure, Construct, Test and Commission an ERS at Bagh-e-Pol					
Schedule No. 4					
Bagh-e-Pol DPP: Standard Tools					
Item No.	Description	Units	QTY	Unit Price	Amount
4.1	ERS Maintenance Tools & Appliances	LS	1		\$0.00
4.2	Test Equipment	LS	1		\$0.00
				Shipping, Handling & Inland Transportation	
Schedule No. 4 Total					\$0.00
Schedule No. 5					
Bagh-e-Pol DPP: Design, Drawings and Documentation					
Item No.	Description	Units	QTY	Unit Price	Amount
5.1	Structural Design And General Arrangement Drawings	LS	1		\$0.00
5.2	Site Electrical Modifications Design Drawings	LS	1		\$0.00
5.3	Control Circuits & Wiring Drawings	LS	1		\$0.00
5.4	General Construction Drawings	LS	1		\$0.00
5.5	As Built Drawings	LS	1		\$0.00
5.6	Maintenance Manual And Completion Report	LS	1		\$0.00
				Shipping, Handling & Inland Transportation	
Schedule No. 5 Total					\$0.00

ICB No.:
OFFER DATE:
SEAL

BIDDER COMPANY:
AUTHORIZED SIGNATORY

Da Afghanistan Breshna Sherkat (DABS)
Islamic Republic of Afghanistan
Pricing schedule

Design, Procure, Construct, Test and Commission an ERS at Bagh-e-Pol					
Schedule No. 6					
Bagh-e-Pol DPP: Installation and Other Charges					
Item No.	Description	Units	QTY	Unit Price	Amount
6.1	Project Management	LS	1		\$0.00
6.2	Project Reporting	LS	1		\$0.00
6.3	Project Insurance	LS	1		\$0.00
6.4	Installation of Energy Recovery System Components	EA	4		\$0.00
6.5	Installation of DG Modification Parts	EA	4		\$0.00
6.6	Installation of Rebuild Parts for Existing Plant DG	EA	2		\$0.00
6.7	Installation of Materials for Exchange of DG with Spare Unit	EA	2		\$0.00
6.8	Relocation of Existing Diesel Generator	EA	0		\$0.00
6.9	Installation of 400 Volt Electrical Interface Power Equipment	EA	4		\$0.00
6.10	Installation of Electrical Interface Control Equipment	EA	4		\$0.00
6.11	Pre-Design Test	EA	1		\$0.00
6.12	Testing and Commissioning	EA	4		\$0.00
				Shipping, Handling & Inland Transportation	
Schedule No. 6 Total					\$0.00
Schedule No. 7					
Bagh-e-Pol DPP: Transfer of Knowledge					
Item No.	Description	Units	QTY	Unit Price	Amount
7.1	Training of Operation & Maintenance Management Staff	LS	1		\$0.00
7.2	On-Site Training During Construction and Commissioning	LS	1		\$0.00
7.3	Training of Operation & Maintenance General Staff	LS	1		\$0.00
				Shipping, Handling & Inland Transportation	
Schedule No. 7 Total					\$0.00
Bagh-e-Pol Total					\$0.00

ICB No.:
OFFER DATE:
SEAL

BIDDER COMPANY:
AUTHORIZED SIGNATORY

Da Afghanistan Breshna Sherkat (DABS)
Islamic Republic of Afghanistan
Pricing schedule

Design, Procure, Construct, Test and Commission an ERS at SIP					
Schedule No. 1					
SIP DPP: Supply of Major Plant and Equipment					
Item No.	Description	Units	QTY	Unit Price	Amount
1.1	Supply of Energy Recovery System Components	EA	4		\$0.00
1.2	Supply of DG Modification Parts	EA	4		\$0.00
1.3	Supply of Rebuild Parts for Existing Plant DG	EA	3		\$0.00
1.4	Supply of Materials for Exchange of DG with Spare DG	EA	1		\$0.00
				Shipping, Handling & Inland Transportation	
Schedule No. 1 Total					\$0.00
Schedule No. 2					
SIP DPP: Supply of Electrical Plant and Equipment					
Item No.	Description	Units	QTY	Unit Price	Amount
2.1	Supply of 400 Volt Electrical Interface Power Equipment	EA	4		\$0.00
2.2	Supply of Electrical Interface Control Equipment	EA	4		\$0.00
				Shipping, Handling & Inland Transportation	
Schedule No. 2 Total					\$0.00
Schedule No. 3					
SIP DPP: Mandatory Spare Parts					
Item No.	Description	Units	QTY	Unit Price	Amount
3.1	Protection System	LS	1		\$0.00
3.2	400 Volt Power Equipment	LS	1		\$0.00
3.3	Control System	LS	1		\$0.00
3.4	Cooling System	LS	1		\$0.00
3.5	Engine/PMG System	LS	1		\$0.00
				Shipping, Handling & Inland Transportation	
Schedule No. 3 Total					\$0.00

ICB No.:
OFFER DATE:
SEAL

BIDDER COMPANY:
AUTHORIZED SIGNATORY

Da Afghanistan Breshna Sherkat (DABS)
Islamic Republic of Afghanistan
Pricing schedule

Design, Procure, Construct, Test and Commission an ERS at SIP					
Schedule No. 4					
SIP DPP: Standard Tools					
Item No.	Description	Units	QTY	Unit Price	Amount
4.1	ERS Maintenance Tools & Appliances	LS	1		\$0.00
4.2	Test Equipment	LS	1		\$0.00
				Shipping, Handling & Inland Transportation	
Schedule No. 4 Total					\$0.00
Schedule No. 5					
SIP DPP: Design, Drawings and Documentation					
Item No.	Description	Units	QTY	Unit Price	Amount
5.1	Structural Design And General Arrangement Drawings	LS	1		\$0.00
5.2	Site Electrical Modifications Design Drawings	LS	1		\$0.00
5.3	Control Circuits & Wiring Drawings	LS	1		\$0.00
5.4	General Construction Drawings	LS	1		\$0.00
5.5	As Built Drawings	LS	1		\$0.00
5.6	Maintenance Manual And Completion Report	LS	1		\$0.00
				Shipping, Handling & Inland Transportation	
Schedule No. 5 Total					\$0.00

ICB No.:

OFFER DATE:

SEAL

BIDDER COMPANY:

AUTHORIZED SIGNATORY

Da Afghanistan Breshna Sherkat (DABS)
Islamic Republic of Afghanistan
Pricing schedule

**Design, Procure, Construct, Test and Commission an ERS at
SIP**

Schedule No. 6

SIP DPP: Installation and Other Charges

Item No.	Description	Units	QTY	Unit Price	Amount
6.1	Project Management	LS	1		\$0.00
6.2	Project Reporting	LS	1		\$0.00
6.3	Project Insurance	LS	1		\$0.00
6.4	Installation of Energy Recovery System Components	EA	4		\$0.00
6.5	Installation of DG Modification Parts	EA	4		\$0.00
6.6	Installation of Rebuild Parts for Existing Plant DG	EA	3		\$0.00
6.7	Installation of Materials for Exchange of DG with Spare Unit	EA	1		\$0.00
6.8	Relocation of Existing Diesel Generator	EA	1		\$0.00
6.9	Installation of 400 Volt Electrical Interface Power Equipment	EA	4		\$0.00
6.10	Installation of Electrical Interface Control Equipment	EA	4		\$0.00
6.11	Pre-Design Test	EA	0		\$0.00
6.12	Testing and Commissioning	EA	4		\$0.00
Shipping, Handling & Inland Transportation					
Schedule No. 6 Total					\$0.00

Schedule No. 7

SIP DPP: Transfer of Knowledge

Item No.	Description	Units	QTY	Unit Price	Amount
7.1	Training of Operation & Maintenance Management Staff	LS	1		\$0.00
7.2	On-Site Training During Construction and Commissioning	LS	1		\$0.00
7.3	Training of Operation & Maintenance General Staff	LS	1		\$0.00
Shipping, Handling & Inland Transportation					
Schedule No. 7 Total					\$0.00

ICB No.:
OFFER DATE:
SEAL

BIDDER COMPANY:
AUTHORIZED SIGNATORY

Energy Recovery System Pricing Summary Sheet
 Energy Recovery Systems for Kandahar Diesel Generators

DABS Project Reference Number:

Bidder Data

Company Name		
Technical Offer Number		
Date of Bid		
Name of authorized Signatory		
Title of Authorized Signatory		

Bid Summary for:	Totals	Bagh-e-Pol	Breshna Kot	SIP		
Schedule No. 1	\$0.00	\$0.00	\$0.00	\$0.00		
Schedule No. 2	\$0.00	\$0.00	\$0.00	\$0.00		
Schedule No. 3	\$0.00	\$0.00	\$0.00	\$0.00		
Schedule No. 4	\$0.00	\$0.00	\$0.00	\$0.00		
Schedule No. 5	\$0.00	\$0.00	\$0.00	\$0.00		
Schedule No. 6	\$0.00	\$0.00	\$0.00	\$0.00		
Schedule No. 7	\$0.00	\$0.00	\$0.00	\$0.00		
Base Lot 1 Each Sub	\$0.00	\$0.00	\$0.00	\$0.00		

Total Base Lot 1 All ERS	\$0.00	
Discount Offered *	\$0.00	
Base Lot 1 minus Discount	\$0.00	

* Discount Methodolgy:

I hereby certify that the above information is correct
 Offer Date:

SEAL

Glossary of Bidding Schedules for Substations

Schedule Number	Item No.	Item Description
<u>Schedule No. 1</u> Supply of Major Plant and Equipment	1.1	Supply of Energy Recovery System (ERS) Components: Supply of all equipment to build an ERS. Includes: turbo-generator with PMG, power conversion electronics, controls, and cooling system. All equipment shall be packaged in a steel transport enclosure. The system shall be fully wired, plumbed, and tested; ready for finstall on top of existing enclosure type generators. All equipment shall be designed and manufactured IAW latest edition of the IEC standards and the rated performance specifications.
	1.2	Supply of DG Modification Parts: Supply of all mechanical equipment necessary to interface with the existing Diesel Generator (DG). Includes all new turbos, exhaust fittings, and supports (as necessary).
	1.3	Supply of Rebuild Parts for Existing DG: All parts required to perform a major overhaul (20k+ hours) of an existing diesel generator per manufacturer's procedures. Parts found faulty, but not included in manufacturer's procedures shall be provided by the Owner.
	1.4	Supply of Materials for Exchange of DG with Spare DG: Supply of all mechanical and electrical equipment necessary to remove an existing 1600kW Diesel Generator from service and install a spare one (presently on the site). Includes all material necessary to provide a 100% operational turn-key generator system. Testing of the new generation shall be included to demonstrate proper operation with remaining plant. Supplier shall furnish all test equipment & fuel. Any replacement parts found necessary on the replacement shall be provided by the Owner.
<u>Schedule No. 2</u> Supply of Electrical Plant and Equipment	2.1	Supply of 400 Volt Electrical Interface Power Components: Supply of all electrical components such as cable tray, conduits, conductors, and supports to properly connect the ERS to the plant power system. All equipment shall be designed and manufactured IAW latest edition of the IEC standards and the rated performance specifications.
	2.2	Supply of Electrical Interface Control Equipment: Supply of all wire, sensors, connectors, relays, and other components necessary to interface the ERS control to the existing DG system.
	2.3	Protection System: The Supply of surge protectors & electrical clamps to protect the supplied ERS electronics.
<u>Schedule No. 3</u> Mandatory Spare Parts	3.1	400V Control Equipment: The Supply of supplier recommended spare relays indialcator lights, and fuses.
	3.2	400 Volt Power System: The supply of all supplier recommended spares for power distribution boards, breakers, power fuses & wires.
	3.3	Control System: Supply of supplier recommended spare parts for the electronic control & conversion cabinet.
	3.4	Cooling System: The supply of supplier recommended valves, actuators, pumps, fans, etc. to maintain ERS cooling system.
	3.5	Engine/PMG System: Supply of supplier recommended spare parts for the turbos, exhaust system, & PMG.
<u>Schedule No. 4</u> Standard Tools	4.1	ERS Maintenance Tools & Appliances: All the necessary tools required to install, inspect, and maintain the entire ERS equipment.
	4.2	Test Equipment: All the specialized test equipment that are necessary to test, maintain, and replace the ERS.

Seal:

Name of Bidder:

Signature of Bidder:

Schedule No. 5 Design, Drawings and Documentation	5.1	Structural Design And General Arrangement Drawings: Structural steel and general arrangement drawings for the equipment and support facilities of the new ERS. Design calculations, detailed design drawings, final design deliverables including detailed supporting analyses.
	5.2	Site Electrical Modifications Design Drawings: All electrical work drawings for connection of ERS sub components and interface to existing plant electrical systems.
	5.3	Control Circuits & Wiring Drawings: The control panels and the wiring connections drawings showing all the control wires from the control panels to existing equipment. Shall also include internal schematics & point to point wiring.
	5.4	General Construction Drawings: Construction Drawings of all the civil and steel structures (including stairs from ground level to elevated ERS enclosure) showing the construction sequencing for all these structures in the ERS installation.
	5.5	As Built Drawings: Updated final documents and design drawings showing all the modifications made on the designs in the field, all CAD drawings for design, construction and installation.
	5.6	Maintenance Manual And Completion Report: All the equipment maintenance, repair and adjustments manuals, and full set of assembly drawings including wiring diagrams. Completion report for each section of the works showing the acceptable testing and proper operations of all the installed equipment. Complete instructions for operations, apparatus lists, and spare parts lists containing information needed for ordering all equipment supplied under the contract. The delivery of the following manuals: general description of the equipment, operating instructions that are suitable for training of personnel, general maintenance instructions, spare parts manuals, all layout, and installation drawings.
Schedule No. 6 Installation and Other Charges	6.1	Project Management: Planning, execution, monitoring and closing all the design, procurement, construction, testing and commissioning activities and ensuring they are carried out IAW the relevant technical standards and design specifications.
	6.2	Project Reporting: The set up of a reporting system from the beginning until the end of the project in which the frequency, format, contents, and the level of details for these reports will be maintained throughout the life cycle of the project.
	6.3	Project Insurance: Coverage for any bodily injury or property damage during the performance of the work. Coverage for faulty workmanship. Coverage for error and omission in the design of the project. Coverage for damage caused by hazard materials. Coverage for damage caused by non-excusable delay. The Coverages shall also cover damages to existing equipment during and after construction.
	6.4	Installation of Energy Recovery System (ERS) Components: Installation of all equipment to build a n ERS. Includes; turbo-generator with PMG, power conversion electronics, controls, and cooling system. All equipment shall be designed and manufactured IAW latest edition of the IEC standards and the rated performance specifications.
	6.5	Installation of DG Modification Parts: Installation of all mechanical equipment necessary to interface with the existing Diesel Generator (DG). Includes all new turbos, exhaust fittings, and supports (as required).
	6.6	Installation of Rebuild Parts for Existing DG: Inastallation of all parts required to perform a major overhaul (20k+ hours) of an existing diesel generator per manufacturer's procedures. Parts found faulty, but not included in manufacturer's procedures shall be prtovided by the Owner, installed by Bidder without additional charge.
	6.7	Installation of Materials for Exchange of DG with Spare DG: Installation of all mechanical and electrical equipment necessary to remove an existing 1600kW Diesel Generator from service and install a spare one (presently on the site). Includes all labor necessary to provide a 100% operational turn-key generator system. Testing of the new generation shall be included to demonstrate proper operation with remaining plant. Bidder shall furnish all labor for testing.. Any replacement parts found necessary on the replacement shall be provided by the Owner, installed by Bidder without additional charge.
	6.8	Relocation of Existing Diesel Generator: All labor, tools, cranes, trucks, permits, necessary to move a 1600kW DG from Bagh-e-Pol to SIP DPP.
	6.9	Installation of 400 Volt Electrical Interface Power Components: Installation of all electrical components such as cable tray, conduits, conductors, and supports to properly connect the ERS to the plant 400V electrical system. All equipment shall be installed per IAW latest edition of the IEC standards and the rated performance specifications.
	6.1	Installation of Electrical Interface Control Equipment: Installation of all wire, sensors, connectors, relays, and other components necessary to interface the ERS control to the existing DG system.

Name of Bidder:

Seal:

Signature of Bidder:

	6.11	Pre-Design Test: Creation of the Pre-Design Test Procedure. This test shall form the basis of design modification on all other DGs of same size. It will provided data necessary for (as necessary) new engine turbos, exhaust modifications, and other mechanical work necessary to assure optimum performance of the ERS with the existing DGs. Providing all pre-design test records & documents.
	6.12	Testing and Commissioning: Creation of the Field Acceptance Test Procedure. Performance of acceptance testing of the ERS according to the Field Acceptance Test Procedure document. Providing all acceptance testing records & documents. Testing shall show the level of fuel savings at 1000kW (DG power alone) meets or exceeds the specification level. Supplier is responsible for all equipment necessary for tests.
Schedule No. 7 Transfer of Knowledge	7.1	Training of Operation & Maintenance Management Staff: Training of the maintenance management personnel on the general operation and maintenance schedules of the ERS. Furnishing of all detailed operation, service, maintenance manuals, and complete spare parts documents list for the training program.
	7.2	On-Site training during construction and commissioning: Training of personnel, workers, and laborers to handle the installation, testing and commissioning of the ERS equipment. Training for six Employer's appointed personnel on factory inspections and witnessing performance tests for the equipment.
	7.3	Training of Operation & Maintenance General Staff: Providing the maintenance general personnel a complete and detailed O&M training program on how to operate and perform the periodical maintenance procedures. Includes all course documents.

Seal:

Name of Bidder:

Signature of Bidder:

APPENDIX F
TYPICAL SPECIFICATIONS FOR ENERGY RECOVERY SYSTEM

SECTION 48 11 00_Rev1

HEAT RECOVERY SYTEM

PART 1: GENERAL

This specification describes the technical features and details for:

Description: waste heat recovery system from operational Diesel
GEN/SET.

Quantity: (12) complete units.

1.1 REFERENCES

The design and performance of the waste heat recovery equipment covered by this specification shall conform to the latest relevant British, IEC, or American Standards. The equipment shall conform to one of the following sets of standards:

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

HEAT RECOVERY SYTEM

1.2 GENERAL REQUIRMENTS

The waste heat recovery equipment to produce utility electrical power needs to be designed and procured for installation and satisfactory operation outdoors under the conditions set forth below. The equipment is to be furnished complete, installed, and tested.

The subject waste heat is present in two distinctive forms. First, the engine jacket cooling water. Second, Exhaust gases (flue gases) produced by the internal combustion process of these engines. There is no limitation as to which technology or combination of technologies can be employed and utilized to achieve this process.

The qualified Bidders should highlight the reliability of their system by presenting examples of successful experience on past or existing installations and operations of their system along with satisfactory customer references.

All equipment under these specifications shall be manufactured in accordance with the latest editions of all applicable codes and standards of IEC-EN or ANSI/IEEE, ANSI, ASTM, NEMA organization standards and all other applicable codes and standards. Manufacturers may choose to consistently follow IEC or ANSI/IEEE standards based on the manufacturer's usual compliance ratings. Specific standard references from one organization may be substituted by an equivalent standard from another organization for consistency of the manufacturer's compliance ratings. For example, an IEEE standard reference may be substituted by an equivalent IEC standard reference.

1.3 SCOPE OF WORK

The successful bidder shall design, procure, deliver, install and test the complete proposed system for the recovery of waste heat produced by generator sets powered by reciprocating engines running on diesel fuel at the Bag-e-Pol, Breshna Kot, and SIP diesel power plants (DPP), and converting it into useful 400V, three-phase, 50Hz utility electrical energy. This co-generated electrical power will then be synchronized with the local AC power bus. It will be the responsibility of bidder to integrate all the pertinent meters, electrical protection and other miscellaneous equipment required for the proper, reliable and safe functioning of the proposed system.

The overall design is for a module type configuration which is installed in a steel shipping container. The container shall house all technical equipment required for ERS power production. Otherwise than interface points, the entire system shall be fully installed and tested in the shipping container. Providing for minimal field connection points.

The system shall be capable of decreasing fuel oil consumption by at least 6.5% at 1000kW DG power production per system.

HEAT RECOVERY SYTEM

1.4 SUBMITTALS

The manufacture shall supply the following preliminary drawings, catalogs, details, reports, specifications, schedules, cost reports and constrains for the acceptance of the preliminary design:

- a) Outdoor instrumentation equipment control wiring termination blocks
- b) Equipment cut sheets and catalogs
- c) Layout of the equipment
- d) Design parameters and description of the main elements
- e) Mass and energy balance
- f) P&ID (Piping and Instrumentation Diagram)
- g) Interfaces generic diagram
- h) Main equipment specifications
- i) Delivery time schedule
- j) Implementation schedule
- k) Commercial conditions
- l) Maintenance schedule highlighting the following:
 - o Frequency of minor and major maintenance operations with details about generators shutdown requirements.
 - o Estimated labour required (in hours) for each task.
 - o Fluids required (oil, coolants, water...) with associated specs and estimated annual volume.
 - o Frequency of parts replacement (spares).
 - o The technical profile of people required to ensure the proper use and maintenance aspects of the system.
- m) Cost reports
 - o Overall complete implementation costs, per unit (if relevant) and/or overall.
 - o Detail of operating costs, per unit (if relevant) and/or overall, including at least
 - 1. Maintenance costs over 5 years
 - 2. Approximate spare parts costs
- n) Generated power reports
 - o Gross generated power(kWe), per generator and/or overall for site.
 - o Net generated power(kWe), per generator and/or overall for site (taking into account any auxiliary, ancillary equipment)

Note: It is understood that performance will also be considered and Compared between bidders, taking into account fuel consumption Of the generators once the system has been implemented.

- O) A brief report on how the installation will be done, an estimate of the timing involved and the likely limits or constraints inherent to their systems (in terms of space, material needed) involved.

HEAT RECOVERY SYTEM

PART 2: PRODUCTS

2.1 Waste Heat Recovery Equipment Complete Control and Instrumentation

a) General

The equipment shall be furnished in accordance with this section. The manufacturer shall provide a standard design for the items within the scope of the specification. All materials and equipment shall be standard product of a manufacturer regularly engaged in the manufacture of the product and shall be in accordance with accepted industry practices for waste heat recovery systems.

The requirements of the waste heat recovery equipment Specification Table 1 shall govern should conflicts occur between them and the written text of these specifications.

b) Codes and Standards

All equipment supplied under this specification shall conform to the applicable standards listed in Section 1.1 above. A steel stairway shall be supplied & installed as part of the ERS.

c) Equipment Required

The manufacturer shall furnish waste heat recovery equipment as specified on the Specification Table 1 included at the end of this section. Waste heat recovery equipment furnished shall be complete with all accessories ready for mounting, assembly, connection, and immediate service.

The quantity and types of waste heat recovery equipment furnished shall be as indicated on the Specification Table 1.

The system is expected to be mounted on top of existing container mounted DGs. It will allow incorporation of two exhaust ports in the floor, connecting to two similar exhaust ports in the ceiling of the enclosure. The enclosure shall house all ERS equipment including generation, power, lubrication, cooling & control systems.

The installation requirements include a standard steel stairs and landing from ground level to access the ERS enclosure.

d) Ratings

The waste heat recovery equipment shall be rated as indicated in Specification Table 1.

The following aspects should be the main criteria for the equipment selection:

- o Performance in terms of net power produced
- o Ease of installation
- o Modularity
- o Reliability and ease of maintenance
- o Footprint (space required)
- o Weight
- o System complexity

The waste heat recovery equipment shall be suitable for operation at the altitude specified on Specification Table 1.

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e) Construction Details

Waste heat recovery equipment shall be designed and fabricated in accordance with the latest revisions of the applicable codes and standards.

Waste heat recovery equipment shall be furnished with all field connection hardware for field mounting on existing containerized generators. All hardware shall be hot-dip galvanized.

PART 3: EXECUTION

3.0 SITE PRE-TESTS

In the early days after award the Bidder shall conduct a pre-test of a Bagh-e-Pol DG system of their choice. Data provided by this test shall be utilized to enhance all remaining DGs in the program. All interface technical data shall also be obtained during this period.

3.1 FACTORY TESTING

Before shipping, the Manufacturer shall test the equipment per the applicable standard tests. Two (2) copies of the test reports shall be forwarded to the Owner and the Engineer prior to shipping. The Manufacturer shall obtain release from the Owner prior to shipment.

3.2 INSPECTION BY THE ENGINEER/OWNER

The Engineer and/or Owner shall be allowed to witness testing performed by the Seller, as well as inspect the equipment at any time. Inspection by the Engineer / Owner shall not relieve the Seller of his responsibility to inspect the equipment, confirm all requirements of testing, and supply complete equipment which satisfies all requirements of these Specifications.

3.3 SPECIAL SHIPPING REQUIREMENTS

Bidder will supply with his bid approximate gross weights, together with the overall physical dimensions of equipment of subassembly as packed for shipment, and a written proposal describing, briefly, the design, contents and number of shipping units.

3.4 ASSEMBLY

In general, the only field connection work shall be;

- Exhaust (dual) in & out of ERS enclosure.
- Relocation of existing mufflers (2/DG) to above ERS enclosure.
- Controls as necessary to the DG.
- 400 volt, 3 phase, power to the DG busses.

HEAT RECOVERY SYTEM

3.5 FIELD & ACCEPTANCE TESTING

The Manufacturer shall submit a "Field Acceptance Test Procedure" document for approval at least six (6) weeks prior to expected formal Acceptance Testing. The document shall, as a minimum, detail step-by-step procedures to demonstrate complete and proper operation of the system. It shall also document all test equipment to be used, including their calibration date. Only equipment with certified calibration lables showing proper calibration performed within the last 12 months shall be used. The Manufacturer shall provide all necessary equipment for all tests. Equipment panel meters shall not be used in lieu of external test equipment.

As part of the Field Acceptance Test Procedure a test shall be included to measure level of fuel savings. This procedure shall document fuel consumed with & without the ERS while producing a total of 1000kW. Bidder shall supply all test equipment for this procedure, including required load banks.

After full field installation on a diesel generator, each system shall be tested by Manufacturer technicians (typical Manufacturer tests may be utilized) to assure proper operation. Upon satisfactory testing, the system shall undergo additional field tests per the approved Field Acceptance Test Procedure.

The Engineer and/or Owner shall be required to witness testing performed by the Seller. Inspection by the Engineer / Owner shall not relieve the Seller of his responsibility to inspect the equipment, confirm all requirements of testing, and supply complete equipment which satisfies all requirements of these Specifications.

Any changes/calibrations/repairs required during the Field Acceptance Test Procedure shall require a re-start of the entire Field Acceptance Test Procedure. Acceptance of the equipment shall not occur until all parts of the Field Acceptance Test Procedure have been successfully demonstrated to the satisfaction of the Engineer and/or Owner, and all documents have been signed by all parties.

3.5 APPROVED SUPPLIERS

Approved suppliers of the waste heat recovery systems /equipment are BOWMAN POWER, CATERPILLAR, ABB, WILSONS, or Owner approved reputable producers of such equipment.

3.6 Training

The successful bidder will also be responsible for the training of local operators on how to operate and maintain the system. This should include but not limited to how local operators of the system can "by-pass" or shutdown the proposed system and be able to use the generators in case of a system failure (or maintenance requirements of the proposed system).

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HEAT RECOVERY SYTEM

EXISTING GENERATOR DESCRIPTION #1	UNIT	VALUE
Quantity	Each	8 engines for enhancement
AC Power	phase	3
Generator brand	name	CAT
Generator type	type	Turbo-Charger, 4 cycle
Generator Manufacturing Year	year	Appx 2012
Fuel Type		Diesel
Power Rating	KW	1600kW max, 1120kW normal
Frequency	Hz	50
SPEED	RPM	1500
Number of Turbochargers	count	4 / engine
Voltage Output	VOLTS	400
Seismic Zone (IBC)		Moderate hazard - Zone 2
Ambient Temperature Range		0°C to 48°C
Ice Build-up	mm	15
Elevation Above Sea Level	meters	1000m
Wind Speed	---	High
Humidity Environment	RH	5 - 90 %

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HEAT RECOVERY SYTEM

EXISTING GENERATOR DESCRIPTION #2	UNIT	VALUE
Quantity	Each	4 engines for enhancement
AC Power	phase	3
Generator brand	name	MTU
Generator type	type	Turbo-Charger, 4 cycle
Generator Manufacturing Year	year	Appx 2012
Fuel Type		Diesel
Power Rating	KW	1525kW max, 1220kW normal
Frequency	Hz	50
SPEED	RPM	1500
Number of Turbochargers	count	4 / engine
Voltage Output	VOLTS	400
Seismic Zone (IBC)		Moderate hazard - Zone 2
Ambient Temperature Range		0°C to 48°C
Ice Build-up	mm	15
Elevation Above Sea Level	meters	1000m
Wind Speed	---	High
Humidity Environment	RH	5 - 90 %

Specification Table 1

ERS DESCRIPTION UNIT	UNIT	REQUIRED VALUE
Quantity	Each	12
Type		Waste heat recovery equipment
AC Power	phase	3
AC Power	Volts	400 VAC Phase-to-Phase
AC Power	Freq	50 Hz
Power Rating	KW	120kW / DG Max
Mounting Type		Steel Enclosure, Outdoor
Incoming Exhaust Connections	2	Through Floor of Enclosure
Leaving Exhaust Connections	2	Through Ceiling of Enclosure
Seismic Zone (IBC)		Moderate hazard - Zone 2
Ambient Temperature Range		0°C to 48°C
Ice Build-up	mm	15
Elevation Above Sea Level	meters	1000m
Wind Speed	---	High
Humidity Environment	RH	5 - 90 %

--- End of Section ---

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