PD-ABH-432

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FINAL REPORT
on
REHABILITATION OF
GIRISHK POWERPLANT

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CONTRACT ICAC-1769-3

FOR

AGENCY FOR INTERNATIONAL DEVELOPMENT
U. S. DEPARTMENT OF STATE
WASHINGTON, D. C.

HARZA ENGINEERING COMPANY
CHICAGO, ILLINOIS

DECEMBER, 1965

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FINAL REPORT
GIRISHK POWER PLANT REHABILITATION

PART I

INTRODUCTION

1-01 SCOPE

This report describes, briefly and in general, the Girishk power plant and its construction and operating history. The report lists in detail the various items of rehabilitation work performed under Amendment No. 3 to Contract ICAC-1769. The report also covers project financing and the results of the training program conducted under the contract. Equipment and commodity deliveries, weather conditions, labor conditions and recommendations for future operation are also covered.

1-02 CONTRACT

The government of the United States of America, acting through the International Cooperation Administration, contracted with the Harza Engineering Company on December 6, 1960 for certain engineering services in Afghanistan. On August 15, 1963, this contract was amended by agreement between the Government of the United States acting through the Agency for International Development and the Harza Engineering Company to provide additional engineering services in connection with the Girishk hydroelectric system.

During the period December, 1963 to March, 1964, the Harza Engineering Company assigned an engineer to the Girishk Power Plant to make a detailed investigation of the repairs required to overhaul the generating units and other equipment and rehabilitate the powerhouse. Additional investigations were carried out under the supervision of the training engineer assigned by the Harza Engineering Company to the Girishk Power Plant in April, 1964. Actual rehabilitation work began on the arrival of the supervisory engineer in August, 1964.

The repairs and improvements described herein were performed by the Afghan Construction Unit (ACU) under the direction of the respective equipment specialists and under the supervision of the supervisory engineer and training engineer appointed by the Harza Engineering Company.

1-03 PLANT LOCATION

Girishk Power Plant is located approximately 2.5 kilometers northeast of the town of Girishk, which in turn is approximately 125 kilometers west of the town of Kandahar. The plant is situated astride the Boghra Canal, which receives its water from the Helmand River by means of a diversion dam located 4.5 kilometers northeast of the plant. The power plant utilizes a 7 meter fall in the canal and supplies electricity via a 44 kilovolt transmission line, running in a southwesterly direction, to the towns and communities of Girishk, Chah-i-Anjir, Nad-i-Ali, Bost, and Marja. The distances of these communities from the plant are respectively 2.5, 34, 39, 55, and 65 kilometers. The communities' receiving substations transform the transmission voltage down to the primary distribution voltage.

1-04 HISTORY

The Girishk Power System was constructed by the Royal Government of Afghanistan with Morrison-Knudsen Afghanistan Incorporated acting as construction contractor. The International Engineering Company, Incorporated of San Francisco designed the project works and performed the field engineering and the supervision of construction.

The construction contract was negotiated between the Helmand Valley Authority (HVA) under the Ministry of Finance of the Royal Government of Afghanistan and Morrison-Knudsen Afghanistan Incorporated (MKA). Financing was arranged under the terms of a loan with the Export-Import Bank. The cost of the project was approximately 2.5 million dollars.

Due to a limited technical staff the HVA was unable to supervise final testing or to take over operation and maintenance of the power plant when the project was completed in July, 1958. Since no personnel were available to operate the power plant, test runs of the plant for the purpose of making final adjustments and checking equipment performance were not carried out. The power plant was kept shut down during the period July 1958 to March 1960.

In March 1960 the HVA arranged with MKA to activate the power plant. A report prepared by MKA dated June 1960 describes the work and tests that were performed, together with recommendation and instructions for subsequent system operation. The report further states that due to lack of operating personnel the power plant had to be

deactivated following completion of the tests. During the period the Girishk plant was shut down, a small amount of power was supplied to the town of Bost (formerly Lashkar Gah) and to Girishk village by electrical generators driven by mobile diesel engines. In the period February to April 1961, attempts were made by HVA to activate the system, but these attempts were unsuccessful. In late July 1961, following transfer of the system from HVA to the Afghanistan General Electric Company of the Ministry of Mines and Industry, the Girishk System was activated. After that time the power plant and system were in operation at partial capacity for varying periods due to several breakdowns of the turbine wicket gate control mechanisms until March, 1964. At that time, the condition of the units had become unsafe for further operation and the plant was shut down for inspection and rehabilitation.

1-05 LOADS

The maximum peak commercial load carried by the rehabilitated Girishk Power Plant as of December 11, 1965 was 1300 kilowatts at unit power factor.

The total generating capacity of the Girishk Power Plant is 3000 kva under a net effective head of 25 feet. The plant normally is operated with only 21 to 22 feet total head and generating capacity is reduced accordingly.

The reasonable firm rating of the plant is therefore approximately 1000 kw at 21.5 feet total head, or 1250 kva at 0.8 power factor. This firm output is based on the assumption that one of the units is down for inspection or repairs.

PART II

DESCRIPTION

2-01 GENERAL DESCRIPTION

The Girishk hydroelectric power plant is an outdoor type installation and consists of two fixed blade propeller type hydraulic turbines direct connected to vertical waterwheel generators and the necessary mechanical and electrical auxiliaries. The generators are housed in individual steel housings. Space is available for a third unit which would complete development of the site.

2-02 STRUCTURAL FEATURES

A. GENERAL. The upstream portion of the structure contains the intake structure and the turbine pits, while the downstream portion contains two galleries housing auxiliary electrical and mechanical equipment. There are five bays in the structure; three are electrical generating unit bays and two are irrigation bypass bays.

B. GATES. The water passage of each of the three unit bays is divided by piers upstream and downstream from the turbine. A total of two head gates and two draft tube gates were originally furnished to unwater one or the other of the two units for repairs and maintenance. However, some time previous to 1962, the two draft tube gates were modified and enlarged to serve as head gates to provide both generating unit bays with head gates. The gates are handled by the power plant gantry crane. Draft tube closure can be accomplished with locally available stoplogs.

Normal control of the water through the units is provided by the turbine wicket gates. Radial gates in the bypass bays regulate irrigation discharges.

C. TRASHRACKS. Trashracks are provided at the upstream end of the bays to prevent floating or submerged material from entering the turbine passages.

2-03 MECHANICAL FEATURES

A. TURBINE AND APPURTENANT FACILITIES. Two 96-inch (2438 mm) Leffel type "A" vertical shaft, fixed blade, propeller type

turbines which develop 2200 horsepower at 187.5 rpm under a net effective head of 25 feet have been installed in an open flume setting in the powerhouse. The gate shaft type governor units are located on the floor near the upstream wall of the electrical gallery.

B. GANTRY CRANE. A double cantilever, A-frame type gantry crane is furnished for use in operation of the gates and installation and maintenance of the units. The crane operates on rails on the top deck of the power plant structure.

A 30,000-pound capacity P & H electric hoist with 52-foot lift is suspended from an I-beam mounted on the crane structure. The I-beam is 18.455 meters long, and allows the electric hoist to be centered over any point between the headgate and tailgate slots. The electric hoist is manually propelled along the I-beam by a chain-operated, geared trolley.

C. INSULATING OIL HANDLING SYSTEM. Transformer insulating oil is stored in a 660 gallon tank located in the mechanical gallery in the Unit 3 bay. Oil is pumped from the tank by a 10-gallon per minute filter press set on the floor of the mechanical gallery. The filter press and pump are in one unit and are portable. Connections and valves are provided for interconnection between transformers, filter press, storage tank, and interconnecting lines.

D. RAW WATER SYSTEM. Water is drawn through three intakes from the three unit forebays to supply a raw water header located on the upstream wall of the mechanical gallery. Located approximately in the middle of the header is a connection which feeds a Bailey duplex, basket-type strainer. From the duplex strainer the line feeds into a tee connection which supplies the cooling water system as well as the fire protection and domestic water systems.

E. COOLING WATER SYSTEM. The three 75-gallon per minute generator cooling water supply pumps draw strained water from the raw water header. The pumps are located on the downstream side of the duplex strainer, in the mechanical gallery. Each pump is capable of meeting the cooling water requirements of one generator. The cooling water pump discharge lines are interconnected in order that any one of the pumps can supply any one generator. These pumps supply water to the generator air coolers and to the generator thrust bearing oil cooler. The return water from the generator air coolers and the oil coolers is discharged directly into the forebay.

F. FIRE PROTECTION AND DOMESTIC WATER SUPPLY SYSTEMS. The fire protection and domestic supply systems are interconnected to give greater capacity to the fire protection system. A check valve prevents flow in the fire protection lines from entering the domestic water line.

The fire protection line feeds six fire hydrants, six hose bibbs and two generator supply lines. Two hydrants are located in the mechanical gallery, two in the electrical gallery and two on the generator deck.

The fire protection system includes an automatic pressure switch to maintain pressure in the system, check, relief and standard valves, the fire hoses which are equipped with two-way nozzles, and the fog nozzle ring headers in the generator housings.

The domestic water supply system receives water under pressure from the raw water pumps through a sand and gravel filter. A hypochlorinator injects chlorine solution into the water leaving the filter and entering the storage tank. Water is supplied from the tank directly to the cold water taps and the electric water heater located in the toilet room in the electrical gallery.

G. COMPRESSED AIR SYSTEM. Compressed air is supplied by two compressors located near the insulating oil tank in the Unit 3 bay of the mechanical gallery. One-half inch compressed air outlets are strategically located throughout the plant. Air also is supplied to the pressure tank of the domestic water supply system and to the governor for supply to the generator air brakes.

H. VENTILATING SYSTEM. The ventilating system has a capacity of 7500 cubic feet per minute. The system consists of a 4500 CFM ventilating unit with fan and filters located on the downstream wall of the mechanical gallery near the diesel engine driven generator set, and a 3000 CFM ventilating unit located on the downstream wall of the electrical gallery. Two 3000 CFM roof exhaust fans, one unit at each end of the power plant, exhaust through the upstream corners of the generator floor. The difference in supply and exhaust quantities provides a positive pressure within the powerhouse to prevent infiltration of air through open doors and windows.

I. EMERGENCY GENERATOR SET. A 25-kilowatt, four-cylinder Continental diesel engine-driven generator set, provided for

emergency station service power supply, is located adjacent to the downstream wall in the Unit 3 bay of the mechanical gallery. Fuel for the diesel engine is stored in a 1000-gallon capacity tank buried in the ground just north of the building.

J. PLUMBING AND DRAINAGE. Sewage collected by the sanitary drainage system is treated in a steel septic tank located under the stair landing in the mechanical gallery in the Unit 1 bay. The effluent is discharged into the tailrace. Surface drainage is collected in open drains located at various points in the power plant and discharged directly into the forebay or tailrace.

K. GAGING FACILITIES. The headwater gage consists of a concrete gage well located near the upstream end of the south bypass flume and a line connecting the concrete well with a steel pipe well in the mechanical gallery. The tailwater gage consists of a steel pipe gage well mounted on the powerhouse downstream outside wall and a gage board and indicator located in the mechanical gallery inside the power plant. A similar board and indicator are furnished for the heawater gage.

2-04 ELECTRICAL FEATURES

A. GENERATORS. The Westinghouse generators are of the vertical shaft, water wheel-driven type. Each generator is rated 1500 KVA at an 80% power factor and 187.5 rpm. Each unit produces three-phase power at 50 cycles and 3.3 kilovolts and is equipped with direct-connected 25-KW, 125-volt main and 2-KW, 125-volt pilot exciters. The units are of the outdoor type and are completely enclosed in weatherproof steel housings.

B. BUS AND SWITCHGEAR. The generators deliver power to the 3.3-kilovolt main bus through air circuit breakers located in the electrical gallery. This bus connects through an air circuit breaker to the main transformers located in the outdoor switchyard situated north of the powerhouse. The bus also connects to the station service transformers which are located near the downstream wall in the Unit 1 end of the mechanical gallery. A three-pole fused disconnect switch is installed between the station service transformers and the main power plant bus.

C. MOTOR CONTROL CENTER. A motor control center feeds the various motors, space heaters, and a three-phase, four-wire panel for lighting and other miscellaneous single-phase power loads through individual circuit breakers. The motor control center is located against the downstream wall in the center of the mechanical gallery. The motor control center contains the selector switches for the air compressor motors, raw water and fire pump motors and control pushbuttons for the generator cooling water pump motors.

D. DIRECT CURRENT SYSTEM. The 125 volt direct current system is powered by batteries located in the Unit 3 bay in the electrical gallery. The batteries are connected to the direct current distribution panel through a switch which is arranged to connect a battery charger into the system. The battery charger operates on 240-volt alternating current supplied from the lighting panel.

Direct current power is supplied to the switchgear and excitation switchboard control power circuits and to the annunciator board located in the electrical gallery control center. Under emergency conditions, the direct current system can be used to supply a small amount of power for lighting.

E. STATION SERVICE TRANSFORMERS. Three, single-phase, 50 cycle, dry type, station service transformers, each rated at 25 kilovolt amperes, transform the 3.3 kilovolt bus voltage to 416Y/240 volts. The 416Y/240-volt power is supplied to the motor control center through a 600 volt, 200 ampere, three-pole double throw, three position switch. A limited amount of power can also be supplied from the emergency diesel engine-driven generator set to the motor control center through the three-position switch.

F. OUTDOOR SWITCHYARD. The switchyard has three main transformers, each rated at 1000 kilovolt amperes, single phase, 50 cycles, to transform the 3.3-kilovolt bus voltage to 44 kilovolts for transmission to the various receiving stations in the service area. A three-pole manually-operated air disconnect switch is provided between the transformers and the transmission line.

PART III

REHABILITATION AND IMPROVEMENTS

3-01 GENERAL

The generating equipment was not in operating condition at the time rehabilitation was begun. Both turbines were out of level and misaligned, with severely worn shafts, main bearings, guide bushings, and packing gland followers. The gate shafts and gate operating mechanisms of both units were loose, worn, and out of alignment and adjustment. The gate shafts of both units in the pits were frozen in the step bearings. The wicket gate pivot bolts and washers of both machines were worn out. Both turbine runners were rubbing on the throat liners. Unit No. 1 had been operated without packing in the main guide bearing and Unit No. 2 was vibrating badly just prior to shutdown. The generator housings were dirty, the turbine governors were dirty, out of adjustment and leaking oil. One power supply cable to the main transformer had been damaged and needed replacement. The powerhouse gantry crane hoist was in poor condition and too slow and dangerous to operate.

The rehabilitation and overhaul of the generating equipment was performed under the direction of specialists furnished by Westinghouse Electric Company, Woodward Governor Company, and The James Leffel and Company, manufacturers of the generators, governors, and turbines, respectively. Rehabilitation of the remainder of the powerhouse equipment was performed under the direction of the Harza engineers.

3-02 TURBINES

1. The turbines were releveled and properly aligned to the centerlines of the generators. This required removing the second stage concrete and cutting the top section of each draft tube free from the remainder of the draft tube just above the field weld joint, resetting it to proper level and alignment, and rewelding each draft tube. The gate case for Unit No. 1 was rotated 5" and that for Unit 2 was rotated 3/4" circumferentially to bring them into proper relation with the gate shaft. This necessitated rotating the curb ring for Unit 2 15 degrees with respect to the draft tube flange so that the curb ring upper flange could be redrilled to suit the new position of the gate case.

2. The turbine shaft for Unit No. 1 was reworked in accordance with the manufacturer's recommendations and a sleeve installed in both the bearing journal and packing gland areas. The sleeve was split both horizontally and vertically and welded to the shaft. The shaft for Unit No. 2 was replaced with a new shaft and new oversize bolts were installed.

3. New bushings were installed in the wicket gates and gate links of both units. The wicket gate pivot bolts, gate washers, gate pins, and gate ring pins were replaced in both units. All gates were reset and refitted for proper operation and closure. Lubrication fittings were provided for lubricating the various bushings.

4. The lead bushings in the bearing support brackets of both units were removed and the bolt holes plugged with steel bushings. The brackets were reset in proper alignment, redoweled, and the new bearing installed.

5. The connecting rod bushings on both machines were replaced.

6. The runners were statically balanced on a ball-bearing balancing device designed and fabricated at the site. The ends of three blades on each runner were built up by welding and ground to drawing dimension.

7. The coupling bolts for the upper end of the intermediate shaft of Unit 2 were carefully examined and found to be in good condition. They therefore were not replaced with new bolts. The new set of bolts were added to spare parts stock.

8. The throat liners were hand ground as required in accordance with standard practice and good workmanship for velocity water passages.

9. The governor wet shaft step bearings of both machines were freed up and the upper and lower bearing brackets were reset. The shaft for Unit No. 1 was completely repositioned and realigned. The lower bearing journals were hand dressed until the bearing clearances were satisfactory. Bell cranks on the gate shafts were oriented to obtain maximum gate opening attainable and the gate shaft couplings were redrilled to suit. Rubber boots were placed on the gate shafts to keep silt and sand out of the step bearings.

10. Draft tube stay rods for both machines were installed and welded in place.

11. All rehabilitation work on Unit No. 2 was carried out with water in the draft tube pit as attempts by the ACU to unwater were unsuccessful. Assembly of Unit No. 1 was expedited by partial unwatering of the draft tube pit thus eliminating many time-consuming rigging operations.

3-03 GENERATORS

1. Shaft runout, bearing clearances, air gap and insulation resistance of both machines were checked and found acceptable. Disassembly of machines for complete inspection was deemed unnecessary by manufacturer's representative and Harza personnel.

2. New brake shoes were installed.

3. New leather cups were installed in brake jacks.

4. New commutator brushes were installed on main exciter of Unit No. 1. Main exciter commutator was hand stoned, polished, and dressed.

5. Generator bearings of both machines were inspected and disassembly was found to be unnecessary. This decision was reached with the concurrence of the generator specialist.

6. Interiors of both generators were thoroughly cleaned.

7. Leaks in braking and jacking piping were repaired.

8. High pressure valves were tested and found to be tight. New valves were placed in spare parts stock.

9. Generator air coolers were inspected and cleaned.

10. Oil was drained and changed in all bearings of both generators.

3-04 GOVERNORS

1. Governor heads and control mechanisms were completely disassembled and thoroughly cleaned. Oil was changed. A complete new pump assembly was installed in the oil pressure supply system of Unit No. 2. Replacement parts were installed and the governors were adjusted for proper operation.

2. PMG for each unit was removed, dismantled, and new bearings were installed.

3. Rotation signal transmitters were installed to indicate breakaway and dead stop of the generators.

4. Gate limit control dials were calibrated and stenciled.

5. Gate position indicators were recalibrated in percent of gate opening, and stenciled.

3-05 GANTRY CRANE

1. The hand-operated monorail chain hoist on the gantry crane was replaced with an electrically-operated monorail hoist to permit handling of head and tail gates at reasonable speeds and to facilitate powerhouse operation and maintenance. Use of this hoist reduces the time required to raise or lower the head gates from approximately four hours to about thirty minutes.

2. Two extensions with knee braces were welded on the side I-beams out to the center line of the headgates. Two chain hoists can be used on the extensions so that the gates can be completely removed from the slots.

3. Short lengths of runway beam were added to both ends of the hoist runway to allow full hoist service on both runway cantilevers.

4. The existing 4500 pound counterweight was removed and a 19,000 pound counterweight was added to the upstream leg bent in order to make the crane stable with loads up to 120 percent of rated hoist capacity.

5. Diagonal braces were installed to reduce unsupported length of the downstream cantilever. The runway beam was welded to its supports to assure proper support.

3-06 MISCELLANEOUS MECHANICAL IMPROVEMENTS

A. LUBRICATION SYSTEM

1. Gate pin and gate ring pin lubrication fittings and additional gate ring lubrication fittings were installed.

2. The turbine guide bearing was furnished with an auxiliary pressurized lubrication system which maintains oil flow into the bearing under all conditions with unit running or idle if the pressure cannot be maintained by the bearing oil pump. Pressure is maintained by an external auxiliary gravity oil tank, equipped with a sight glass, mounted 8 feet above the generator deck.

3. Pressure gages, installed in the electrical gallery, allow a check of pressure in the bearings and indicate malfunction of the system or the need for packing gland adjustment or replacement.

4. Pressure switches were installed to give an alarm when turbine bearing oil pressure differential over water pressure drops to 1 psi.

5. Hatches were cut in the generator deck to provide access to the gate shaft bearings for lubrication without unwatering. Separate grease lines were installed from the connecting rod bushings and the lower and upper gate shaft bearings for lubrication through the new hatches.

B. TURBINE PIT DRAIN

An automobile hydraulic jack having a 12" lift (obtained locally) was modified by welding a U-shaped steel plate to its base. The jack enables one man to raise the turbine pit drain stopper, avoiding the necessity of using a rod through the chain ring and requiring four men for lifting. The jack can be carried to either unit as required.

C. RAW WATER SYSTEM

1. The position of the pressure switches for the raw water pumps was changed in order to correct the water hammer and chattering of switches and contactors when the pumps were operating.

2. The hypochlorinator was put in working order. It was also found that the system, as installed, made it impossible to back-wash the filters. This installation was corrected.

3. The chlorine supply was replenished.

D. TRASHRAKING PROVISIONS

A "drag-rake" was designed to be used in conjunction with a drag line or truck crane, thus facilitating trash removal.

E. HEADGATES

1. The headgates were cleaned and painted.

2. Bottom "J" shaped rubber seals of the gates were adjusted to prevent leakage.

F. EMERGENCY DIESEL GENERATOR

1. A heavy duty 6-volt engine starting battery and a selenium type "high-low" battery charger were installed.

2. Fuel filters were replaced, fuel system cleaned, overhauled, and adjusted.

G. TOOLS AND SPARE PARTS

Essential tools and spare parts were purchased, and, together with those on hand, were inventoried.

3-07 MISCELLANEOUS ELECTRICAL IMPROVEMENTS

A. STATION BATTERY

1. A new 60 cell, 120 ampere-hour battery and battery rack were purchased and installed.

2. Battery maintenance record sheets were furnished to the operators.

B. BATTERY CHARGER

A self-regulating selenium rectifier charger was purchased and installed.

C. TEMPERATURE GAGE PANELS

A resistance temperature detector indicator was repaired. All temperature indicators were recalibrated.

D. CONTROL PANELS AND SWITCHGEAR

1. A recording graphic frequency meter was installed on the switchboard.

2. A recording graphic voltmeter was installed.

3. A recording graphic wattmeter was installed, using two current transformers obtained locally, and using existing bus potential transformers.

4. Two register type hourmeters, one for each generator, were installed.

5. A new voltage regulator was installed. The old regulator was repaired and kept as a spare.

E. TRANSFORMER PRIMARY FEEDER CABLE

The two feeder cables on phase 3 were replaced with new cables, as both were in damaged condition.

3-08 POWERHOUSE

A. GENERAL

The entire powerhouse and all equipment were painted. A vacuum cleaner was furnished and a cleaning routine and schedule set up. A card index type maintenance schedule was set up.

B. FIRE PROTECTION

Dry powder type fire extinguishers suitable for use around electrical equipment were purchased to provide adequate fire protection.

C. LOUVERS AND VENT COVER

1. A manually-operated louver was installed over the ventilation opening in the downstream wall at the emergency generator in the mechanical gallery at El. 822.05.

2. Plywood covers were to be fabricated for use in covering the air inlet to the ventilation fans. This work had not been completed by November 15, 1965.

3. Removable plugs were installed in the pipe sleeves through the downstream wall in the mechanical gallery.

These improvements were accomplished with local materials.

D. CATWALK UNDER GENERATOR

Turbine disassembly work required the making of large openings in the generator deck north and south of the units. These openings have been made into hatches, used for access to new catwalks which extend from the hatches to the steel platforms under the generators. The catwalks are oriented across flow through the powerhouse and do not pass under the deep concrete beams which caused the old catwalks to be immersed in 3 feet of water. Material for these improvements was obtained locally.

E. WATER STILL

The water still was abandoned, with USAID approval, for the following reasons:

1. The still had burned out several times because it was operated without water and cannot be repaired.

2. Purchase of a new still was not considered justified.

3. A two-year supply of distilled water is on hand.

4. Distilled water is readily available from two reliable local sources.

F. OIL TANKS

Only four barrels of oil have been used to date since the plant was first completed. In view of the lower cost of replacement of the oil, the installation of a storage tank and a piping system, as originally proposed, is not justified. Concurrence of the USAID Mission on this action was obtained. Material and personnel shortages at the ACU would also have precluded its fabrication and installation.

G. STORE ROOM

Storage facilities, including storage bins and shelving for parts and supplies and a storage rack for pipe and steel stock were installed. Storage space was gained by flooring in and enclosing the storage area over the irrigation by-pass adjacent to Unit No. 3 bay at the electrical gallery level.

3-09 LABOR

Laborers were provided for the rehabilitation work by the ACU and were mostly unskilled and inexperienced and required constant supervision. One American mechanic-foreman, with occasional assistance of a second foreman, was employed for this supervision. That portion of the work not carried out under the direct supervision of the various manufacturer's technicians was conducted by the Supervisory Engineer or the Training Engineer.

Hours worked were from 8:00 a.m. to 4:30 p.m. portal to portal from Chah-i-Anjir, 22 miles from Girishk over rough roads. During the hot summer months, hours worked were 6:00 a.m. to 1:00 p.m. During the month of Ramazan hours were changed to 8:00 a.m. to 3:00 p.m.

All the Afghan holidays were observed by ACU personnel.

3-10 WEATHER CONDITIONS

Much of the rehabilitation work was carried on during the extremely hot summer months of June through September, 1964 and 1965. Temperatures at the powerhouse sometimes reached 120° F. or more. During the cold winter months of 1964-65 temperatures dropped below freezing and many working hours were lost in thawing out frozen equipment. Dust also was especially prevalent during this period and dust storms were frequent.

During the rainy season, considerable working time was lost due to flooded roads. The round trip from Bost to Girishk covers 66 miles. Many more miles were frequently driven during this period and on at least one day, Harza technicians drove 191 miles round trip to Girishk. Because of lack of communications to inform them which roads were flooded, various routes across the desert had to be tried to get through to the plant.

PART IV

PRESENT CONDITION OF POWER PLANT

4-01 GENERAL

The rehabilitation of the power plant and its equipment has been completed. Defective equipment has been repaired or replaced and all equipment and the structure repainted. Two dummy shafts were fabricated for use in precutting each size of packing in the shop. Use of the dummy shafts will simplify packing replacement and eliminate the difficult fitting operation in the turbine pit.

A model study is now being made at Kabul University in an effort to determine the cause and propose remedies for the serious hydraulic disturbances which cause frequency variations in the units, accompanied by continuous correction of wicket gate position and continuous motion of the gate control mechanisms.

Unit No. 2 was started up after rehabilitation was completed on March 17, 1965. It was accepted by USAID on April 11, 1965 and immediately turned over to ACU for operation.

Unit No. 1 was started up on August 28, 1965 after rehabilitation was completed. It was put in commercial service on a trial basis on September 4, 1965. Official acceptance tests were conducted on September 25, 1965, and the unit, as well as all work under amendment No. 3 to Contract No. ICAC-1769-3 was accepted subject to completion of certain items of work. As of November 15, 1965, all of these items of work had been completed with the exception of installation of louvers or plywood air intake covers, removal of oily gravel from the switchyard and completion of painting in the powerhouse. These work items were not completed by the ACU apparently due to manpower shortages and/or scheduling difficulties. The power plant has been in continuous commercial service since September 4, 1965, without interruption except for one scheduled outage on October 27, 1965 to allow removal of the water rheostat.

PART V

EQUIPMENT AND COMMODITY DELIVERIES

5-01 GENERAL

All equipment and supplies purchased for use on the project are listed below. Prior purchase authorization was obtained from the Mission for all major purchase expenditures. Due to the inability of the A. C. U. to supply certain essential small tools, instruments, and supplies, they were purchased without prior Mission authorization to expedite their arrival. Also, a bolt rethreading die, which had been stolen, was replaced.

P. O. No.	Equipment	Used As	Ordered	Received	Condition on Receipt	COST Purchase	Ship	Total
411	Turbine parts 1 set packing 1 upper gland 1 bearing bushing 40 upper washers 40 lower washers	R*	1/29/64	8/15/64	good	$1350.25	Combined with 414	$1350.25
414	Turbine parts 1 turbine shaft 10 coupling bolts 12 reamer fit bolts 1 reamer 1 special reamer 1 hand ratchet	 R R R SP** SP SP	2/19/64	8/15/64	crate demolished	$7246.00	$437.15	$7683.15
416	2 cans Minerallac	R & SP	2/21/64	4/10/64	good	4.89	shipped with Kandahar diesel parts	4.89
418	500 ft. cable	R & SP	2/21/64	11/ 3/64	damaged	799.48	162.58	962.06
421	Voltage regulator 1 control element 1 control switch	R	2/25/64	7/29/64	good	2097.65	105.63	2203.28
422	Batteries 64 cells 2 thermometers 2 vent plug hydrometer syringes 2 portable hydrometer syringes 1 set intercell connectors 1 set terminal connectors 1 cell lifting device 2 connector bolt wrenches 1 lb. coating grease 1 set cell numbers 1 2-step battery rack 1 qt. touchup paint 1 charger 1 extra control unit 1 extra set silicon diodes	 R & 4SP SP SP SP R R SP SP R R R R R SP SP	2/27/64	8/20/64	damaged: 6 cells broken 7 cells cracked plastic spacers broken	3134.69	535.62	3670.31
429	Exciter brushes 2 sets main exciter brushes 2 sets pilot exciter brushes	 1 R & 1 SP SP	3/16/64	5/14/64	good	57.41	39.00	96.41
429	2 sets collector ring brushes	SP	3/16/64	6/ 9/64	good	138.55	126.23	264.78
429	2 sets brake shoes	R	3/16/64	9/10/64	good	See collector ring brushes.		

*R indicates used in rehabilitation.
**SP indicates spare parts. For convenience, tools left at plant also are shown as SP.

P. O. No.	Equipment	Used As	Ordered	Received	Condition on Receipt	COST Purchase	Ship	Total
431	Governor parts 7 rod ends 7 rod end pins 4 ball bearings 2 vibrator kits 2 vibrator rods 4 ball arm pivot pins 8 ball arm bearings 4 spacers 4 slide blocks 4 slide block pins 4 springs 2 stationary sleeves 2 sets relay packing 2 packing glands 2 plungers and bushings 4 control plungers 2 bonnet assembly 2 string packing 2 pilot valve service kit 2 plunger rod ends 2 Hannifin valves 1 rotary element 2 chain and sprocket kit 1 oil seal 2 bushing 2 operating rod 2 bushing 2 springs 2 switches 4 bearings	R	3/20/64	9/ 1/64	good	$2776.70	$140.87	$2917.57
459	Repair tools for turbine 1 level 4 ratchet hoist 1 lb. .33" music wire 1/2 lb. .022" music wire	 SP SP R & SP R & SP	6/10/64	8/ 6/64	good	1090.71	571.32	1662.03
457	Turbine gate parts 1 set packing upper & lower 1 upper gland 1 lower gland 1 bearing bushing 42 upper wicket gate bushing 42 lower wicket gate bushing 82 shear link bushing 8 connecting rod bushing 1 agrilite turbine bearing insert 1 set coupling bolts & nuts	R	6/ 9/64	12/ 9/64	crate demolished 3 missing 1 bent	4400.30	122.31 Truck Remainder of costs with 469	4522.61
469	40 gate pivot bolts & nuts 40 gate pins 40 gate eccentric pins & nuts	R			some sprung	4101.00	2004.02	6105.02
470	90 lube fitting for gate links 20 lube fitting for gate operating ring 3 1/8" pipe tap drills 3 1/8" pipe taps	R				84.00	shipped w/469	84.00
429	2 generator brake valves	R	7/13/64	8/ 6/64	good	121.60	shipped w/459	121.60
487	2 pieces shaft sleeve & sufficient welding rod	R	8/26/64	11/15/64	good	2004.00	387.50	2391.50

P.O. No.	Equipment	Used As	Ordered	Received	Condition on Receipt	COST Purchase	Ship	Total
489	Governor parts 2 rotation signal transmitter with transformers 2 speed switch with dowels and head screws	R	9/ 9/64	12/21/64	good	$662.00	$190.45	$852.45
509	Replacement parts for damaged batteries 15 jars 20 plastic spacers 20 rubber separators 10 tubes cement 10 packages studs & nuts	R	10/ 7/64	11/25/64	good	247.25	291.98	539.23
525	Governor parts 2 pair rack pinion gears 2 handwheel worm gear shaft 2 sets drive bearing 4 upper drive bushings 4 lower drive bushings	SP	11/ 9/64	2/11/65	good	718.20	123.34	841.54
	Instruments & Supplies	SP	11/20/64	2/25/65	good			
533	1 chlorine comparator & reagent					82.95	shipped w/518	82.95
518	1 hand lamp					65.34	245.95	311.29
522	1 clamp type V.-A. meter w/case, bulbs, resistor					69.16	shipped w/518	69.16
521	1 V.O.M. with case, batteries					69.18	shipped w/518	69.18
520	57 fuses, 4 synchroscope lamps					465.26	shipped w/518	465.26
534	12 3 3/4 lb cans chlorine powder	R & SP	11/20/64	2/11/65	good	35.90	109.87	145.77
538	9 sets double cup leather packing	R 2 SP	11/30/64	4/ 7/65	good	62.90	shipped w/519	62.90
536	400 lbs. grease	R & SP	12/ 1/64	8/ 7/65	good	74.00	shipped w/517	74.00
543	Governor parts 2 drive gears 2 keys	R	12/ 7/64	12/21/64	good	95.40	74.02	169.42
517	7 crates tools & parts 10 4-in-1 shim assortment 1 set steel drills 1 drill index case 1 resin core solder 10 reels vinyl tape 10 reels rubber tape 1 trouble light 1 snips 1 tap & die set 1 pipe cutter 1 pipe threader 5 cans cutting oil 1 bench drill press 1 bench grinder 2 grinder eye shield 1 sharpening stone assembly 3 replacement stone 4 C clamps 1 pipe vise 1 tool & die makers kit 18 cans Smooth-on cement 12 qt. pipe joint compound 100 aluminum oxide sheets 50 emery cloth medium 50 emery cloth coarse 100 crocus cloth 100 garnet sheets 100 flint sheets	SP except paint	12/ 8/64	4/ 7/65	good unless otherwise stated 10 bent & leaking	2899.10	492.71	3391.81

P. O. No.	Equipment	Used As	Ordered	Received	Condition on Receipt	COST Purchase	Ship	Total
517	7 crates tools & parts (Cont'd.)							
	1 50# welding rod							
	1 50 ft. water hose & couplings							
	4 pair hose coupling							
	12 hose clamps							
	100 hose washers							
	10 gallons rust remover							
	12 wire brushes							
	10 5-gallon cans asphalt primer				bent & leaking			
	30 gallons zinc chromate primer				bent, 2 empty			
	8 5-gallon pails aluminum paint							
	6 5-gallon cans concrete deck paint				bent, leaking, 1 empty			
	1 level with							
	1 level vial							
	1 plumb vial							
	1 45-degree vial							
	4 fire extinguishers, portable							
	1 50-lb container recharger chemicals							
	2 flexible plate mica							
485	Electric hoist & beam	R	12/28/64	5/ 2/65	good	8726.00	1038.44	9764.44
	1 spare set load brakes	SP						
	1 spare set disc brakes	SP						
	1 spare load brake pawl & pawl pin	SP						
	1 spare set electrical contacts & coils	SP						
484	Meters		12/23/64	1/20/65	good	1689.02	467.71	2156.73
	Recording frequency meter	R						
	Recording voltmeter	R						
	Recording wattmeter	R						
	2 register time meter	R						
	Record rolls	some SP						
	Inkwells	"						
	Pens	"						
	Cleaners	"						
483	Air circuit breaker	SP repaired	12/28/64	5/19/65	damaged: arc chutes broken, baffles broken, frame bent, some corrosion evident	2350.00	222.47	2572.47
517	Tools	SP	2/15/65	8/ 7/65	good unless otherwise stated, though crate broken	See first entry under 517		
	1 soldering iron							
	1 basic electricians kit							
	1 portable electric drill							
	1 anvil							
	1 compressed air torch							
	1 welder	repaired			damaged			
519	5 gallons silicone	some SP	3/ 3/65	4/ 7/65	good	33.32	109.81	143.13
578	Tools		3/26/65	4/30/65	good	94.28	50.95	145.23
	3 dial indicators	SP						
	1 combination square	SP						
	1 bolt die	SP - stolen - replaced						
	6 grease fittings	R						
592	2 pressure gages	R	4/20/65	5/ 3/65	good	8.29	27.20	35.49

P. O. No.	Equipment	Used As	Ordered	Received	Condition on Receipt	COST Purchase	Ship	Total
607	2 pressure switches	R	5/21/65	6/17/65	good	52.67	27.82	80.49
645	Circuit breaker parts 2 arc shield 3 front arc horn assemblies 3 interrupter stacks	Repair of damaged breaker	7/ 1/65	8/17/65	good	109.57	195.95	305.52
652	Flax packing	R	7/ 7/65	8/17/65	good	85.02	66.69	151.71
682	Teflon packing	R	9/11/65	10/ 7/65	good	103.46	1.89 local, handcarried	105.35
-	Assorted grease fittings	R & SP	-	-	good	9.67	handcarried	9.67
698	Asbestos packing (8 boxes)	SP	10/18/65	-	-	1331.60	85.36	1416.96
	(26 boxes)	SP	10/18/65			See above	79.09	79.09
	(7 boxes)	SP	10/18/65	(on back order)		-	-	-
701	Chlorinator Foot Valve	R	10/29/65	-	-	7.80	0.29	8.09

Those items of equipment listed as damaged or broken have been replaced or repaired with the exception of the three missing shear link bushings, the bent connecting rod bushing and the sprung gate pivot bolts. The shortage was made up by reusing those parts which had not been worn. Due to repeated rehandling enroute there was no recourse to shippers for replacement of damaged articles. USAID Mission concurrence was obtained on this point. The circuit breaker element was received in damaged condition. The element was reworked to fit in process of damage repair. Contact fingers which could not be reworked were supplied by the breaker manufacturer at no cost. Those items of expendable supplies which were damaged or lost enroute will not be replaced.

PART VI

PROJECT FINANCING

6-01 CONTRACT

The Harza Engineering Company was retained by the ICA on December 6, 1960 to perform certain services in conjunction with the Arghandab Dam in Afghanistan. The basic contract, No. ICAC-1769, covered engineering services in conjunction with design and construction of the Arghandab Hydroelectric Power Plant, a transmission line to Kandahar and Kandahar International Airport, receiving substations required to integrate Arghandab generation with existing Kandahar and International Airport systems, and improvements to the Kandahar distribution system. The contract was amended on March 28, 1962 to require additional services as a result of inclusion of a reregulating dam and appurtenant structures and a survey of the Girishk hydroelectric system. The contract was again amended on September 21, 1962 to require additional services as a result of the imminent failure of the Kandahar diesel plant. The contract was further amended on August 15, 1963 to require additional services in conjunction with the rehabilitation of the Girishk hydroelectric plant and training of operators for said plant. The contract was again amended on November 18, 1964 to increase the authorized lengths of stay of manufacturers representatives at the Girishk plant and to increase the contract limitation on funds allocated for equipment, tools and parts purchase. The contract was again amended on February 26, 1965 to terminate that portion pertaining to Girishk operator training. The contract was finally amended on August 13, 1965 to require additional services in connection with purchase of parts for the Kandahar diesels and to increase the funds and extend the completion date on the Girishk rehabilitation. A request dated November 12, 1965 for an increase in the total obligated funds under the contract to compensate for reimbursable expenses omitted from previous estimates and to extend the contract termination date to allow completion of this report and other office services was denied for lack of a parallel substantiating request from the Mission.

6-02 FINANCES

The funds allocated under the contract and all changes therein due to amendments subsequent to amendment No. 3 are presented in Table VI-1 below. Local expenditures were made from a revolving fund of 120,000 Afghanis established in January of 1964. An additional sum of 60,000 Afghanis was advanced in March of 1965. An accounting of all expenditures made from this fund was made periodically to Mission accountants and upon closing of the fund on completion of work under the Contract.

TABLE VI-1

Reference Description	Am. No. 3	Amendment letter dated 2/26/65	Amendment letter dated 8/13/65	Amendment request letter dated 11/12/65
Overall Ceiling				
Local Currency				
Art. II (a) Afghanis	10,305,000	10,305,000	10,305,000	10,305,000
Art. II (a) Pakistani Rupees	1,311,000	1,311,000	1,311,000	1,311,000
U.S. Dollars				
Art. II (a) Initial Surveys and Arghandab and Kandahar work	$1,397,390	$1,411,390	$1,420,890	$1,420,890
Girishk Rehabilitation work	205,769	205,769	237,188	245,944
TOTAL	$1,603,159	$1,617,159	$1,658,078	$1,666,834
Art. II (b) Fixed Fee				
Initial Surveys and Arghandab and Kandahar work	56,125	56,125	56,125	56,125
Girishk Rehabilitation work	12,456	9,712	12,456	12,456
TOTAL	68,581	65,837	68,581	68,581
Art. II (e) Obligated Funds				
Initial Surveys and Arghandab and Kandahar work	1,453,515	1,467,515	1,487,015	1,487,015
Girishk Rehabilitation work	218,225	215,481	249,644	258,400
TOTAL	1,671,740	1,682,996	1,736,659	1,745,415

Note: Amendment letters dated September 12, 1963 and June 2, 1964 refer to Kandahar Diesel Plant, and accordingly are not listed above. However, the above amounts have been adjusted to reflect the changes made by these letters.

PART VII

TRAINING PROGRAM

7-01 GENERAL

A training engineer was assigned to Girishk Power Plant by the Harza Engineering Company in April, 1964. Assigned to the plant at that time were: 1 chief operator, 4 operators, 4 assistant operators (graduates of Kandahar Manual Training School), and two oilers. None of these men spoke English or had any knowledge of power plant operation. Better housing and pay were suggested as a means to attract better-class personnel. This was promised but not done. Complete school and experience records were promised but not furnished. No trainee able to read the manufacturer's instruction books or parts catalogs, or with prior operating experience, to be trained as the training engineer's counterpart and future plant superintendent, was assigned at any time.

In May, 1964, the four assistant operators were sent to Chah-i-Anjir for instruction in English, Physics, and Math, but they were actually put to work as helpers in the electric maintenance shop.

The training engineer arranged with the school superintendent for use of a laboratory in Lashkar Gah High School to teach operators basic physics. ACU was unable to furnish transport to allow the operators to attend.

ACU was asked to furnish an interpreter to assist in lessons to trainees, since no English-speaking personnel were in the plant. ACU declined to do so, saying that English-speaking operators would be assigned soon. Harza hired an interpreter. The following information was then learned about the trainees:

Abdul Wahab, Power Plant Superintendent; 4 years school; read and write Farsi; claimed experience, 14 years electrician.

Abdul Ghafar, Operator; 7 years school; read and write Farsi and Pushtu; claimed experience, 8 years electrician.

Marson, mechanic; no school; illiterate; claimed experience, 3 years dragline and cat mechanic.

Queteb, mechanic; no school; illiterate; claimed experience, 2 years dragline oiler.

Mahmed Sirwar, mechanic; 4 years school; read and write Farsi and Pushtu; claimed experience, 7 years bulldozer operator.

Faiz Mohammed, operator; 9 years school; Farsi and Pushtu; claimed experience, 2 years electrician and one year diesel operator.

Jan Mohammed, cleaner; no school, illiterate.

English classes were begun with help of interpreter and books provided by the Head of the Human Resources Advisory Group, USAID/Bost.

Four additional men reported in late July, 1964:

A. R. Nazari, graduate of Afghan Institute of Technology at Kabul; English about 5th grade level; read and write Farsi; no experience.

Kandahar Manual Training School graduates previously mentioned:

Mohamad Sidiq; graduate of KMTS; read and write Farsi; very young; no experience.

Gul Nabi; graduate KMTS; read and write Pushtu; very young; no experience.

Fazal Ahmad; graduate KMTS; read and write Farsi; very young; no experience.

In August, 1964, trainees were provided with the following books: English Through Pictures; Technical English; Physics; Math for Cadastral Survey Students. All above books were loaned to training engineer by the Head of the Human Resources Advisory Group.

In early August, Niyaz Mahamad; no school; illiterate; no claimed experience; was assigned as a trainee.

Classes were held twice each day in English, electrical theory, basic math, and operation and maintenance procedures.

A series of lessons were written and mimeographed. It was hoped they would be translated into Farsi and Pushtu (but no one willing to do so was found). It was the opinion of the Power System Director that even the first lesson would be too difficult for the trainees to grasp.

In October, 1964, two more trainees were assigned: Gul Mohammad, and Khoroddin, both graduates of Kabul German Technical School; literate in Farsi; no English; no claimed experience.

In November, 1964, Mr. Nazari was named as Technical Supervisor for the plant. Mr. Fiaz was named as Maintenance Supervisor.

In January, 1965, the training engineer was successful in having a Peace Corps English teacher assigned to the plant. English lessons were given three times each week. Few students attended regularly. These lessons were discontinued in July, 1965.

Also in January, 1965, Mr. Nazari was named as training engineer's counterpart and future plant superintendent.

March 1, 1965, USAID directed that training program be discontinued for lack of competent trainees.

During the course of the training program a maintenance schedule was set up and a complete new Operation and Maintenance Manual was written.

In addition to formal classes, the trainees worked with the supervisory engineer, various manufacturer's technicians, and the training engineer in rehabilitation of the plant in order to become familiar with plant equipment.

The training engineer has continued to work with the above-named men after termination of the training program since no other personnel were assigned. Since operation of the plant began in April, 1965, no experienced person has been assigned either to manage the plant or to supervise operation or maintenance. This work has therefore been done by the training engineer, using the above mentioned operators and ACU personnel who had assisted in rehabilitation.

Progress of the trainees, taking into consideration their educational and experience backgrounds, has been as follows:

Abdul Wahab: quit in June, 1964.

Abdul Chafar: quit in June, 1964.

Marson: quit in June, 1964.

Queteb: Works hard but little progress; no English and no effort to learn.

Mahmed Sirwar: A good worker but little progress; has acquired some English.

Fiaz Mohammed: Very good progress. He has watched and learned so that he can go ahead on his own. He is making real efforts to properly run the power plant.

Jan Mohammed: little progress. He is a hard worker and very pleasant and cooperative.

A. R. Nazari: very good progress. His attitude has improved and he has made sincere efforts to learn.

Mohamad Sidiq; Gul Nabi; Fazal Ahmad; are willing workers. They have attended English classes and made fair progress.

Niyaz Mahamad: deceased.

Gul Mohammad; is quite young with no previous experience. He has made fair progress, attended English classes and made efforts to learn.

Khoroddin: quit after training program was discontinued.

PART VIII

GENERAL OBSERVATIONS AND RECOMMENDED FUTURE PROCEDURE

8-01 GENERAL

It is difficult to reconstruct and evaluate the conditions which existed in the past and which contributed to the need for the rehabilitation performed under this contract. The rehabilitation work consisted of correction of misalignment in the equipment, repair and overhaul of damaged or worn parts, and installation of new parts, components or systems which were found necessary or desirable to improve the operation of the equipment or to facilitate the work of the plant operators. In treating each of these items separately it can be stated that the misalignment in the equipment is believed to be due in general to a combination of initial installation, subsequent attempts at repair and movement due to operation under heavy loads. The generally deteriorated condition of the equipment is due primarily to inadequate maintenance and in part to improper operation. A portion of the difficulty encountered with the turbine shafts and guide bearings is due to operation under silty water conditions for which the bearings are unsuitable. The silty water, combined with the misalignment, caused shaft and bearing wear and increased frictional loads on the wicket gate operating mechanism. Infrequent or neglected maintenance and lubrication further aggravated the situation. In addition to abnormal wear due to the above causes, further accelerated wear was due to almost continuous governor action caused by the existing hydraulic disturbances in the forebay and tailrace. This frequent if not constant operation under heavy loads also acted unfavorably on the mountings and alignment of the gate shafts. It can, therefore, be seen that the effect of these conditions was cumulative and mutually reinforcing.

The installation of such items as recording meters, the rotation signal transmitters, and electrically operated hoist could possibly be considered as unjustified in the light of the original design of the power plant which may have required minimum overall expenditures. Past operating experience, however, has indicated that these items are essential.

The rehabilitated plant can operate under present operating conditions only with continuous attention to maintenance and lubrication. The hydraulic disturbances which cause continuous governor operation must be greatly reduced or eliminated. After correction of the hydraulic conditions, the frequency of lubrication may possibly be reduced. However, the presence of abrasive silt in the water will continue to require frequent washdown and cleaning.

8-02 RECOMMENDED FUTURE PROCEDURE

The successful operation of the plant will depend on the above mentioned correction of hydraulic conditions, on the quality of maintenance performed and on the skill and experience of the operators. It is recommended that capable and experienced personnel be hired to operate the plant and that a very carefully observed maintenance program be instituted. In particular, it is mandatory that a well-schooled superintendent be assigned to the plant. He must have good knowledge of the English language to enable him to consult and apply the various manufacturers' maintenance instructions and to order replacement parts when required. Establishment of a system for procurement of parts and supplies in advance of actual need will assure their availability when the actual need arises.

The sand and silt remaining in the tail pits of the units should be removed completely when the canal is next unwatered. If the deposition of this material continues to occur, then a regular procedure for its removal should be established.

HARZA ENGINEERING COMPANY
CONSULTING ENGINEERS
RIVER PROJECTS
400 WEST MADISON STREET
CHICAGO 6, ILLINOIS
CABLE ADDRESS "HARZENG CHICAGO"
TELEPHONE RANDOLPH 6-3451

ARGHANDAB PROJECT, AFGHANISTAN

CONTRACT NO. ICAc-1769-3

AMENDMENT NO. 3 - GIRISHK REHABILITATION

MONTHLY PROGRESS REPORT NO. 28

FOR PERIOD: NOVEMBER 28, 1965 - FEBRUARY 28, 1966 (FINAL)

SCOPE OF WORK:(See Report No. 23 for period ending July 24, 1965)

ENGINEERING

Chicago Office: Work was done in assisting mission in tracing turbocharger casing shipment lost or delayed enroute to destination.

Revised pages and additions to Operating and Maintenance Manual were prepared and sent to the field.

The remaining seven boxes of 13/16" packing were received, packed and sent to the field.

The final report was completed and distributed as required by Contract ICAC 1769-3.

Shipment of Mr. Van Hamel's household goods was stopped and they were placed in storage in Beirut.

Assistance was given to Mr. F. A. Dale of Burns and Roe in preparation for his visit to Afghanistan.

Various outstanding bills were received and processed for payment.

Field: Mr. Bishop continued to handle all company concerned matters in the field although he was no longer in our employ. Mr. Bishop, who had entered the employ of the ACU on leaving Harza, extended his contract with the ACU until late May.

PERSONNEL

Approximately 0.80 man-month was expended in the Chicago office subsequent to the period covered by the previous report.

ENGINEERING PROGRESS: 100 %.

HARZA ENGINEERING COMPANY

H. J. Job
Project Manager