BURMA

EDIBLE OILSEEDS PROCESSING AND DISTRIBUTION PROJECT

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End of Project Report

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Submitted By:
Agricultural Cooperative Development International
50 F Street N.W. Suite 900
Washington, D.C. 20001
Phone: (202) 638-4661
Fax : (202) 626-8718
and
Sub-Contractor:
EPE Incorporated

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EOPD TEAM MEMBERS

Richard R. Perry, Oilseed Processing Specialist and Chief of Party

Derrick A. Burgess, Master Mechanic, Mandalay

David R. Zaleski, Master Mechanic, Rangoon

ACRONYMS

AID - Agency for International Development
ACDI - Agricultural Cooperative Development International
CID - Cottage Industries Department of the Ministry of Cooperatives
CD - Cooperative Division
ECC - Equipment Commodities Commission
EOPD - Edible Oil Processing and Distribution Project
GOB - Government of Burma
K - Kyat (Unit of Burmese Currency)
MOC - Ministry of Cooperatives
MT - Metric Tons
PD - Planning Department
PP - Project Papers
SRUB - Socialist Republic of the Union of Burma

GLOSSARY

Hard facing:	Application of a special alloy metal to a base steel using welding techniques; produces an abrasion-resistant material
Hardening:	A metallurgical technique used to harden metals so as to make them more wear-resistant
CIF:	Cost, including freight
Kyat:	6 kyat = US $1.00
Pyas:	Burmese unit of currency - 1/100 of a kyat
Viss:	Burmese form of measurement = 3.6 lbs.
Jig:	A gauge against which one measures all outputs of a particular part to see that all meet the same specification
Fixtures:	A device designed to hold a piece still while it's being machined.
Syndicate:	an organization whose membership consists of all the township societies within a Division or State; it coordinates the entrepreneurial activities of its members
Machining:	A method used to make tools, parts, or machinery; this process produces objects of a specific dimension
Normalizing:	Process by which stresses are relieved in a metal part (metalurgial term)
Quenching:	A fast method of cooling hot metal by plunging it into certain liquids
Optical Pyrometer:	High temperature measuring devices
Carburization:	Process by which carbon is added to steel that steel can be heat-treated and made harder
Chill casting:	Method of casting using a chill mold; produces a very hard part
Crushing capacity:	Amount of oilseed processed

Expeller: The entire machine used to press oil

Expeller worm: Device rotating within the expeller cage; it presses the seed against cage bars.

Expeller shaft: Special arrangement of many individual worms put together in a manner to provide optimum performance; can also be called a "press worm arrangement."

Expeller cage or barrel: A collection of cage bars, or barrel bars, held in a special frame; special spacing between bars which facilitates expulsion of oil, but retains crushed seeds.

I. EXECUTIVE SUMMARY

I.A General Project Background and Project Goals

The five-year Edible Oil Processing and Distribution Project (EOPD), was awarded to Agricultural Cooperative Development International (ACDI) and subcontractor, EPE, Incorporated in August 1986. The EOPD technical assistance team, an oil processing engineer and two master mechanics, arrived in Rangoon, Burma in October 1986 and began project implementation at that time. In September 1988 the project was terminated due to political unrest and the team was evacuated to Thailand.

The project was conceived and designed to increase the production and purity of edible oils in Burma. Project technical assistance focused on fifteen selected oil mills, four national industrial producer workshops, and technical and managerial staff working with the Ministry of Cooperatives and locally-based mills and workshops.

Burma's edible oil industry is severely handicapped due to the low production capacity of its expeller (screw-press) mills and the poor quality of the oil and oilseed cake produced in the extraction process. The extraction machinery in these mills--referred to in this report as the "expeller"--generally is in a very poor state of repair because of the lack of appropriately designed and fabricated wear parts and incomplete knowledge of repair and maintenance of these parts and of the equipment involved in edible oil processing. In addition to problems with the machinery, the quality and quantity of oil are affected by the absence of seed selection standards, poor preparation of seed for pressing, and unsanitary handling of the oil and oilseed cake once pressing is complete.

As a result of three major accomplishments and four associated achievements, the project has made a strong beginning toward upgrading the Burmese edible oil industry. This was done primarily by building on existing local expertise supplemented by on-the-job training, and by using materials (often available locally) and processes appropriate to the Burmese situation. It cannot be emphasized too strongly that the solutions found to date are a result of the high degree of enthusiasm and cooperation shown by workshop and mill technical staffs.

Though there are many project accomplishments, three in particular must be considered major by any standard. In a relatively short period (between February 1987 when the project workplan was implemented and April 1988 after which the political situation made project work practically impossible), three mechanical breakthroughs

were made which resulted in a considerable increase in oil and cake production and in cost savings in mill operation. Despite constraints of no project commodities (raw materials, equipment, parts) in Burma at the time of team arrival and lack of certain local materials and machinery, the EOPD and Burmese technical staff produced:

* New and longer-wearing expeller worm and collar parts from chill cast iron alloy;

* A re-designed expeller shaft arrangement more suitable to Burmese oil pressing conditions;

* A re-designed and longer-wearing expeller cage bar.

(see Appendix N for engineering drawings; main text for description of parts and their function).

Four associated achievements which contributed to the production of these three major ones were the developing of the "master ingot" used in the process of making the iron alloy, the finding of a temporary solution to the expeller shaft problem of worn gears and bearings, the incorporating of mass production and dimension quality control practices into the machine part production process, and the beginning of the process of semi-annual seminars for oil mill managers to share their experiences in mill operation.

These achievements directly tackled the long-standing problems of poorly-wearing parts and inadequate technical knowledge of how to make, maintain and repair parts in order to assure proper mill operation. As a spinoff, oil production was increased and mill operation costs reduced.

These special project accomplishments were major contributions to completing the project tasks of:

* Improving production and quality of edible oil through the rehabilitation of oil mills;

* Upgrading the skills of a technical and managerial cadre to increase their capacity to guide rehabilitation and manage the future of the oil mills and workshops;

* Improving the workshops so they can manufacture long-wearing quality parts for the oil mills and provide them with repair and maintenance service.

I.B Accomplishments

Though the EOPD product was partially terminated in September, 1988, which is about halfway through the project, it should be noted that significant accomplishments were made in the five project activity areas towards fulfilling the project goals.

I.B.1. Oil Mills

Five old oil mills have been substantially rehabilitated with a projected capacity increase of 300%. One additional oil mill of relatively recent vintage (1985), has had its operational capacity increased from 24 MT to 37 MT annually for a standard yearly schedule of 300 days operating 24 hours a day.

The EOPD team developed standardized oil mill layouts and parts designs appropriate for Burma. These EOPD standard mills are capable of an annual production capacity of 9,000 MT for a 24-hour day (300 days per year) and consist of only 3 expellers utilizing a 2-pass system as opposed to the typical 4-6 pass operation that is currently the practice. A reduction in operating costs of 40% was achieved by improved extraction capacity through the use of better machine parts and maintenance/repair procedures, and less unscheduled downtime. A reduction in fuel costs of 41% was a direct result of boiler reconstruction and the use of insulation and steam traps.

Oil quality has been improved through the use of sterilizing equipment and the repair and cleaning of oil storage drums. A "mother" lab for oil analysis has been set up at the Ministry's Cottage Industry Department (CID), three analysis labs have been set up in EOPD project mills and the equipment for twelve other labs is on order. The first in a series of semi-annual seminars for mill managers has been held.

I.B.2. Workshops

Primarily through the metallurgical seminar, the EOPD team taught the staff of four target workshops techniques for making chill cast iron alloy which results in harder expeller worm and worm collar parts. A new way of fabricating expeller cage bars was made possible as a result of teaching the processes of carburization and heat-treating by which scrap steel can be improved to produce a longer wearing part. Advances in parts production are assured a secure place in oil production as a result of technicians learning how to mass produce each part so that multiple copies are all made to the same dimensions. High standards of parts production were further

assured by the introduction into the workplace of modern quality control and materials testing instruments.

The team discovered that one workshop at Sein Pan was more a collective of individual enterprises and, as such, did not have a central machine shop and foundry where the EOPD could do training. The team designed a central facility and drew up engineering plans for its development.

I.B.3. Training

Two long-term overseas trainees completed graduate work in chemical engineering and returned to Burma in July 1988 to work as team counterparts. Four others are studying for Masters degrees in nutrition and food technology in the U.S. Eight short-term overseas trainees completed programs in laboratory instrumentation, computer maintenance and repair, and cooperative management and have been assigned to the MOC to work with the project. In addition, two observation tours of five participants each were made to oilseed processing operations in the U.S. and the Federal Republic of Germany.

Two short-term consultants conducted in-country seminars: Dr. Peter Weiser, metallurgist, and Dr. Hans Strop, laboratory consultant. The metallurgy seminar proved particularly valuable in contributing to the breakthrough made on the design and fabrication of a new expeller worm.

I.B.4. Laboratory

A "mother" laboratory was upgraded at the CID with $121,000 of equipment procured from the U.S. Technicians were trained in its use.

Three satellite labs were set up in project mills. Equipment for twelve others was ordered as was replacement equipment for the proposed labs.

I.B.5. Library

Coordination with other development projects doing library work in the same field was organized. For the technical library, over 500 professional journals and related materials were ordered as well as 300 items for operating the facility and training.

I.C. Recommendations

The EOPD team strongly recommends that the project be re-started as soon as possible for a two year project.

A modified target is to rehabilitate 10-15 mills in a 2-year period. The criteria for choosing mills for rehabilitation should be based on their potential for producing 9,000 MT per annum.

Another objective would be to build on what workshop technical and management personnel have learned about manufacturing repair parts for the oil mills using locally available materials. A program for continuing in-service training should be designed to ensure reinforcement of what they have already learned. The Rangoon workshop should be included in this process. Details of the continuation plan are discussed in Appendix M.

II. THE PROJECT: AUGUST 1986 TO SEPTEMBER 1988

II.A. THE EOPD PROJECT AS PLANNED

Context

There are about 2,000 mills in Burma processing edible oils. Four hundred of these are programmed to be rehabilitated by 1995. The goal of the EOPD project was to upgrade, i.e. partially rehabilitate, approximately 10-15% of these (40-60 mills). These mills are both cooperative and private enterprises. The project focused on 15 mills which were to be completely rehabilitated. All 2,000 mills are of the screw-press type.

As a result of the planned upgrading efforts, it was expected that mill output would increase significantly and that a better quality of edible oil would be produced. It was anticipated that the EOPD project, through on-the-job and formal training, would increase the capability of the Ministry of Cooperatives and its applicable subunits to plan, evaluate and implement programs that will improve edible oil production, quality and distribution.

The EOPD project can be thought of as the keystone of a number of projects in the agricultural assistance sector of A.I.D./Burma. Since 1982, this assistance has contributed to the development of a cadre of trained researchers, managers and agricultural agents who are now actively working in crop production. A.I.D.'s agricultural production assistance has focused on secondary crops such as maize and oilseeds. The agricultural production projects, "Maize and Oilseed Project" (482-0005) and the follow-on "Burma Agriculture Production Project" (482-0007), plus the "Agricultural Research and Development Project" (482-0012) contributed to improvements in crop yields, dissemination of basic technology and knowledge of agricultural production through research.

The EOPD project was planned as a complement to these other projects in that it was to create conditions where the increased production of edible oilseed could be channelled into more productive edible oil-producing mills. The edible oil industry itself would become more efficient and productive as a result of the improved capability of the Ministry of Cooperatives and its subunits to oversee operation of this portion of the agro-industrial sector.

The total project cost was estimated at $14.244 million. The A.I.D. contribution was to be $9.5 million (all grant) with the Burmese contribution budgeted at $4.74 million. This is the equivalent of 67% and 33% of the total project cost from A.I.D. and

Burma, respectively. The A.I.D. contribution was to cover all foreign exchange costs of technical assistance and include $500,000 in local currency costs required for local support staff and local costs for consultants, training, commodities and evaluation. The Burmese Government, cooperatives, and private firms were to contribute labor for rehabilitation efforts and maintenance, investment in expanded facilities, space for laboratory, personnel and administrative expenses and other local support costs.

TABLE II.A.I.

Summary of Cost Estimates and Financial Plan
(US$ 000)

Source	A.I.D. FX	Host Country LC	Host Country LX	Host Country LX	Total
Technical Assistance	2,046	500	--	161	2,707
Training	861	--	--	133	994
Equip. & Commodities(1)	4,316	--	--	230	4,545
Op. & Maintenance	--	--	--	4,199	--
Evaluation	250	--	--	21	271
Inflation	478	--	--	--	478
Contingency	1,079	--	--	--	1,049
TOTAL	9,000	500	--	4,744	14,244

The "Mid-Term Evaluation Report" of the EOPD Project (482-0006) of July 1988 presents the following table comparing projected and actual expenditures of the SRUB and of USAID.

Table II.A.2.

Projected vs. Actual Earmarked Expenditures (Figures shown in $000s) 1.

Country	Projected	Actual	Deficit
SRUB	1,835*	108	1,727 = 93%
USAID	6,181	3,335	2,846 = 46%

1. Calculated at $1.00 = 6.00 Kyats
(Source: EOPD Mid-Term Evaluation, p. 51)

The evaluation team judged that many of the shortfalls of the project were due to the late arrival of commodities, a subsequent reduction in the number of mills to be rehabilitated, and the lack of candidates for U.S. training. The project team found that the SRUB did not supply counterparts, such as a full-time Burmese Project Director and a Project Manager, office equipment and supplies, or support for the EOPD team in the field, such as project vehicles.

Content

The EOPD project may be thought of as five separate, but potentially mutually reinforcing, activities. Each is first described below in terms of project outputs and their objectively verifiable indicators as these are presented in the "Project Design Summary Logical Framework" and the project RFP. However, this EOPD Final Report will clearly point out why this initial formulation of the project had to be changed because of the reality of field conditions. These changes are spelled out below in each of the five sections that present the five project activities (II.B., below).

1. SCREW-PRESS OIL MILLS

Fifteen mills (9 cooperative, 6 private) were to be completely rehabilitated and an additional 30 to 45 were to be upgraded to varying degrees. Rehabilitation plans included technical assistance

in the installation of additional boilers, steam pressure-reducing valves, steam traps, steam pressure gauges and thermometers. These items were to be of U.S. manufacture. Cleaning screens, conveyors, elevators, oil pumps and oil tanks manufactured in Burma were also to be installed. The oil mills would also require technical assistance in the design and installation of an additional ring on the cookers and installation of level controls in each ring.

The upgraded mills were to be improved so that they could process at a capacity 220% greater than their current capacity. With rehabilitation, the quantity of oilseed to be processed would more than double. For various reasons, Burmese mills are producing at only 10 to 15% of the manufacturer's specifications of a machine's capacity. Given the existing environment in Burma, the percentage increase called for is a reasonable target. Rehabilitated mills would be more efficient and extract more oil from a unit of seed cheaper and faster. They then would be able to handle more than double the tonnage of seed they now handle, with fewer pressings, which results in a better quality product. The oilseed cake produced would have less oil content thus increasing its storage life and improving its marketability.

Every mill was to have adopted annual maintenance procedures and better managerial techniques, safety measures, and improved facilities for storing seed oil and cake.

2. WORKSHOPS (INDUSTRIAL PRODUCERS' COOPERATIVES)

Four workshops were to receive equipment, tools, raw materials and technical assistance to improve their operations, particularly in the manufacture of screw-press parts. At the end of the project, these workshops would be better equipped, more productive, safer to work in, and more responsive to expanding their work beyond truck and auto repair and to becoming more involved in working with the oil mills.

Through training activities, workshop personnel would acquire or upgrade skills in machine shop operation, metal fabrication and heat treatment, and use of precision measurement tools and their application; increase knowledge of steel products, their application, mechanical properties, machinability and weldability; and gain knowledge of product safety requirements and the ability to establish an acceptable safety program. Training would also cover the topics of precision measurement tools and their calibration; heat treatment process; preventive maintenance of machine shop equipment and safety habits; installation and operation of new equipment; and quality control.

3. TRAINING

Different types of training were to be provided to several administrative units in the Ministry of Cooperatives and to technical staff in the screw-press mills and the workshops. The project called for training in the U.S. of five M.S. degree candidates and six long-term trainees in one-year programs, both the responsibility of the Office of International Training, A.I.D./W. The EOPD team would have responsibility for in-country training of 20 short-term trainees, and for overseas observation tours for 45 participants (EOPD Project RFP, pp. 7, 8).

The units of the Ministry of Cooperatives that would receive training are underlined in the chart below:

Chart II.A.1.

THE MINISTRY OF COOPERATIVES - BURMA

Cooperative Department:	Planning Division
Cottage Industries Department:	Innovation Division Technical Services Division Training & Education Division

The Planning Division's skills in data collection, storage, retention and analysis were to be greatly enhanced under the project as would its project preparation, appraisal, monitoring, and evaluation capabilities. The Cottage Industries Department would have better trained personnel and managers with a working knowledge of modern oil processing operations. The CID and its divisions were to be better able to carry out future programs in upgrading existing screw-press mills, operating new ones, and beginning preparations for work on solvent extraction plants. Information dissemination activities would be enhanced and outreach expanded to provide information and technical assistance to cooperatives and related private sector facilities. The CID would be able to carry out an expanded program of quality control work and would be able to continually update skills through the facilities of an expanded technical library in the Training & Education Division.

4. LABORATORY

A fully equipped and staffed reference laboratory was to be set up as part of the upgrading activity for the laboratory now housed in the Innovation Division. This activity would involve the design and/or provision of new equipment, including a bench solvent extraction plant, information dissemination equipment, technical assistance, and training of laboratory technicians.

5. LIBRARY

The technical library in the Training and Education Division would be upgraded by the addition of 500 new books, 20 periodical subscriptions, and 15 technical journals and other publications.

II.B. PROJECT CONSTRAINTS AND ACCOMPLISHMENTS

Three Particular Constraints

Project constraints and accomplishments are presented in the context of each of the above five project activities. However, the project was confronted with several general constraints that could not be relegated to any particular aspect of the project. Of these, three stand out in particular:

II.B.1. The disparity between the scheduled funding of inputs and actual inputs. There were two aspects to this problem. The parts, commodities, and machinery/materials that were to be in place at the time of the EOPD team arrival were not there. The other aspect concerned the reduced level of support from the SRUB. The AID/SRUB agreement stipulated that the SRUB would provide $917,000 in services, equipment and personnel. At the time of project termination, the SRUB had provided only about $108,000. This considerably hampered project implementation (see Mid-Term Evaluation).

II.B.2. The inconsistencies between the AID/ACDI and AID/SRUB contracts. The ACDI contract stipulated that the EOPD team would be provided personal and project vehicles, office equipment and supplies by AID. A PIL stipulated that the projects vehicles and other supplies would be provided by the SRUB. They were not.

II.B.3. The lack of clarity as to the method of repayment of loans for equipment and commodities. Mills and workshops must pay for supplies and materials provided by the EOPD project. The loans used for this purpose need to be negotiated with financial

institutions and a reasonable interest rate obtained and loan repayment procedures worked out. The SRUB and MOC were to assist with these negotiations. This has not been done.

Additional Project Constraints

Burmese Staff

Problems existed in three areas. The SRUB Project Manager and the Director General for the EOPD were not with the project at full-time status. At another level, EOPD counterparts would have been new hires for the MOC. The failure of the MOC to expand its staff meant that the EOPD team members did not get counterparts. Finally, for the EOPD to fulfill its obligation to get candidates for training and for it to staff the new laboratories and the upgraded technical library, the MOC had to approve training candidates and to expand its staff. Selection of training candidates was slow and MOC staff expansion did not take place as anticipated by the EOPD PP.

SRUB Support of the EOPD Technical Assistance Team

It was a continuing problem for SRUB to provide local funds for EOPD team transportation, supplies, and office equipment.

Travel and Travel Accommodations

All project travel required special permission. Approvals were often unduly delayed or not granted at all. Team members based in Rangoon had an particularly difficult time. After their initial inspection visit in the field, it was a year before they were again able to travel outside Rangoon to continue working. This factor was devastating to a project requiring extensive travel to visit mills and workshops and coordinate the rehabilitation work which is its core.

Special Project Vehicles

They were required to carry portable equipment, machinery and supplies over rough terrain. They were not supplied which caused delays and added to the expense of the EOPD project because of the need to find an alternative mode of transport. The first, and only, vehicle provided by the SRUB was given only a few months before the project was terminated. Vehicles for the personal use of project members were to be available when the team arrived but were not received until April 1987, six months later. Vehicles for personal and project use had to be rented up to that point. Since rented vehicles could not be taken out of Rangoon, for the duration of the

project personal vehicles, once received, had to be used for field travel because no others had been supplied.

Importing Project Commodities for Rehabilitation

Vital raw materials and supplies such as the master ingots, various kinds of steel for making parts for the mills, and various kinds of machinery, though ordered, had not arrived in Burma as of September 1988, except for the machinery for the workshops which arrived in May, 1988. The workshop machinery, however, had not been processed out of customs as of September 1988. Most of the imported items were urgently needed. Not having them affected the project implementation schedule.

II.B.1. OIL MILLS

The project design consisted basically of rehabilitating fifteen oil mills (9 cooperative, 6 private). The EOPD team actually worked with six mills: Meiktila Township Cooperative Oil Mill, Prome Syndicate Oil Mill, Sagaing Mill, Taungtha Mill, Mandalay Mill, and the Magwe Township Cooperative Oil Mill which was not in the original target group of mills.

Before rehabilitation could take place, the EOPD team needed to determine the benchmark figures that accurately represented current operating capacity of the mills and the current quality of the pressed oil as that is represented by the residual oil and moisture content in the pressed oilseed cake. Measurement of plant capacity was done using the "long ton" quartering method for sampling, and determination of the residual oil and moisture content of oilseed cake was done using the weighing and analysis standards established by the American Oil Chemists Society. The results obtained gave the EOPD team the oil mill performance benchmark data against which it could then measure future improvements in oil mill processing capacity and in quality of oil and oilseed cake (see Table II.3., below, for data on improvements obtained).

To appreciate the effort involved in rehabilitation, it is helpful to know what are the basic problems which result from the Burmese method of processing oil compared to the standard method of processing.

a. The seeds are not adequately cleaned. The presence of hulls during pressing reduces the oil yield. The seed contains much sand, soil, stones and other debris. This wears out the expellers quickly and contaminates the pressed oil and oilseed cake.

b. The seeds are not rolled or cracked. This makes any conditioning or cooking impractical. The expeller becomes a roller or cracking machine, a function for which it was not designed.

c. The seed is not cooked or heated. This makes oil removal much more difficult. When the seed is not cooked, the oil is not sterile, nor are the enzymes normally present in oil deactivated. Cooking the oilseed changes their physical structure so that more oil is pressed from them and it is more easily filtered.

d. Moisture is present in the pressed oil even though the oil is filtered in most of the oil mills. Moisture is present because there is no heating, cooking or drying to remove the water from the seed.

Oil mill rehabilitation requires three separate areas of activity:

1. Procurement of materials necessary for rehabilitation.

2. Redesigning the oil mills, rebuilding the existing equipment with replacement parts, adding and installing new equipment as required, and standardizing all the expellers to reduce the number of replacement parts to a practical level.

3. In-country training in oil mill operation and maintenance procedures both through informal training on-the-job and more formal training through seminars.

The constraints encountered in the process of rehabilitating the oil mills are described first to clearly set the environment, and then accomplishments are presented.

OIL MILL CONSTRAINTS

There were three major constraints, all involving the machinery found in the mills.

Repair and Maintenance of Expeller Gear (Transmission) Drives. The EOPD project was not initially designed to deal with the problems presented by worn gears and bearings. There were no provisions in the RFP and the PP for this type of work since none of the pre-project studies had investigated the state of the expeller gear transmissions. Due to the age of the expellers in Burma and the lack of proper lubricating oils, most of the gears

and bearings in the expellers are worn out. It is essential that the main expeller pressing shaft rotate concentrically so that parts do not strike other members of the expeller and break them. Worn gears and bearings affect rotation and increase the likelihood of damage.

The team discovered within sixty days of arrival that as many as 54 of the 59 expellers in the 15 original target oil mills had bad gear cases. Expeller transmissions consist of special gears and bearings, none of which are available in Burma. These parts must be imported. The manufacture of these items requires specialized technology far beyond the scope of this project. Not providing initially for gear and bearing repair and maintenance delayed the completion of the renovation of all oil mills. The EOPD team did, however, find a temporary solution to this problem and a long term solution was in progress at the time of project termination (see item 3 under Accomplishments, below).

Expeller Cage Bars. One of the most important wear parts in an oil expeller press is the cage bar, also referred to as the barrel bar. When the bars are assembled in a heavy metal frame around the expeller shaft, they provide for the drainage of the edible oil as the seeds are pressed in the expeller. These parts are subject to high wear and pressures. They must meet high performance standards. The EOPD team found that many expeller cages had bars that were badly worn and no longer conformed to the shape required for proper performance, thus affecting production of oil.

Expeller Worm Drive Shaft Arrangement. In the early days of the project, the EOPD team found that there were at least 9 different kinds of expellers in the project mills (Appendix K for description of the various types). Together, there were over 900 different parts in these expellers. One set of parts which needed rehabilitation--the pressing shaft and the worms and tapered collars placed between them--required materials and machines for working with steel, and hardfacing equipment and rod, none of which were in Burma at the time. The difficulties to be faced in upgrading just this one set of parts, plus the overall large number of different expeller parts, prompted the team to tackle the problem of the worms and collars in a manner different from that envisaged in the original project design. Since none of the expellers had a good shaft arrangement, the EOPD team decided to design a new one. In early 1987 the team started to use local materials and re-design the worm and collar arrangement to determine what was most appropriate for the Burmese situation (see item 2, below, under Accomplishments).

OIL MILL ACCOMPLISHMENTS

Rehabilitation of the project oil mills has progressed to the point that six oil mills (5 are EOPD targets) were in various stages of rehabilitation at the time of EOPD team evacuation in September 1988. The most notable accomplishments are in the standardization of the expeller shaft arrangement and the expeller parts, plus solving a key problem of worn expeller shaft gears and bearings which had seriously affected the productive capacity of the mills. The other accomplishments are either a result of, or have reinforced, these three.

1. Standardization of Machine Parts

The parts and machinery for the oil mills in the EOPD project were standardized, most notably the expeller worm and cage bar (explained more fully below in the Workshops section) and the gear shaft arrangement for the expeller (see 2, below).

2. Re-Design and Standardization of Expeller Shaft Arrangement

Many different worm and collar arrangements were in use at the start of the EOPD project. The team took into account the particular operating conditions in Burma and used locally available materials for the re-design of these parts. It developed a standard design through computer programming and testing at the mill in Mandalay. Through standardization using this new "Burma Design," a big step has been made toward reducing the extremely high number of different expeller parts from 900 to 50.

3. Solution to Problem of Worn Gears and Bearings

Devised a short-term solution to the problem of worn expeller shaft gears and bearings whereby gears are made from cast iron. Though they last only a few weeks, this is long enough to determine the new capabilities of the rebuilt expellers (see Workshop section, below). The long-term solution to this problem is the importation of gears and bearings. PIO/Cs were written for these parts.

4. Increased Oil Yield and Pressing Capacity

Introduced new technology that both increases the yield from pressing the oilseeds and expands the capacity of a mill to process oilseed. The amount of increase in the yield is determined by measuring the amount of oil that remains in the pressed oilseed cake (percentage of residual oil, referred to as "R.O."). A decrease in

residual oil means that more oil is produced. It is most desirable to reduce the R.O. in the cake.

Table II.B.3.

Improvements in Production of Oil Mill Products:
Pounds of Oil Yielded/Residual Oil Content of Oilseed Cake

OIL MILL	PRIOR TO PROJECT		CURRENT	
	Lbs /day	R.O.%	Lbs /day	R.O.%
MEIKTILA	3,390	12-15%	10,750	7.5%
PROME	4,560	13-18%	12,450	7.5%
SAGAING	21,600	8.4%	36,000	7.5%
TAUNGTHA	2,940	14.5%	10,750	7.5%
MANDALAY	23,200	10-11%	43,200	7.5%
TOTALS	55,590	AVE-10.85%	113,150	AVE-7.5%

Note: RO (residual oil) is the amount of oil left in oilseed cake after pressing of the seed.

Production data are based on eight-hour days. Most operations in Burma are 16 to 20 hour days. The data come from actual performance at these mills. The above represents a 203% increase in capacity/ hour, however, with downtime decreased by 50%, the increase in average daily production is over 400%.

Oil production was increased an average of 41.23 lbs./ton of oilseeds processed. This is equivalent to an average increase of 99,968 lbs/month of edible oil for the five mills in Table II.3. When projected to the fifteen project oil mills, this represents an average annual increase in oil production of 6,400 metric tons.

To evaluate the potential for an increase in the production of edible oil, it was necessary to examine all the machinery associated with the production of oil and to determine the mechanical condition and capability of each part, plus look at the work processes employed in the production of oil at each mill. After the machinery was partially rehabilitated and mill personnel were taught the proper procedures for operating their plants, a 200% to 300% increase in the production of edible oil was achieved at the Mandalay and Sagaing cooperative oil mills.

Each oil mill in the project was designed to have a standard "annual" production capacity of 9,000 metric tons. This is based on a normal, worldwide practice of operating 300 days per year, 24 hours per day.

5. Improved Oil Quality

Oil quality was improved by the introduction of an oil sterilizer to dry-process oil. This increases oil stability. The importance of product cleanliness was explained to mill workers and methods for repairing and cleaning drums used to store oil were implemented. A high-pressure barrel and drum washer was developed.

6. Reduced Operating Costs

By reducing downtime for unplanned machine repair and by increasing the productive capacity of the mills, the team introduced methods to reduce oil mill operating costs by about 40%.

7. Energy Saving Methods

Methods were developed and equipment installed to recycle steam condensate in order to conserve energy and save water. In none of the oil mills that the EOPD team visited in Burma did they observe the standard practice of good steam boiler operation or use of basic methods of heat energy conservation. These subjects are not specifically mentioned in the EOPD project's RFP, but as far as the team was concerned, these practices are a necessary and integral part of producing edible oil in an efficient and hygienic manner.

After discussions with oil mill managers and operating personnel in regard to these subjects, some excellent responses were received. The chairman of the Meiktila township cooperative oil mill, who carried out our recommendations for good operating and heat conservation procedures, reported to the team and at an EOPD seminar in Mandalay that he had achieved a 40% savings in steam boiler fuel consumption. This Burmese official's confidence in the EOPD recommendations and what he achieved at his oil mill established the credibility of the EOPD project in the minds of many other oil mill mangers in the area. Subsequently there were numerous requests for visits and advice from project team members to oil mills not a part of the project.

8. Use of Waste Bio-Mass as Fuel

A system was developed to convert existing oil mill boilers, used for heat processing, so that the boilers could operate on materials such as peanut hulls, rice husks, cotton seed hulls or other waste bio-mass. These conversions were made using local materials.

9. Establishment of Laboratories and Maintenance Workshops

Oil mill laboratories and maintenance workshops are in place at Mandalay, Prome, and Meikila. Equipment for the other 12 oil mill labs was ordered in February 1988.

10. Operations Manual

The EOPD team wrote an operations manual which is to be published in Burmese. It is for the use of all oil mill technicians. The manual sets out instructions on how to lay out and set up an oil mill and how to operate and repair the machinery. Specific instructions are given in the manual on which parts are to be used and parts lists are provided. At the time of evacuation of the EOPD team, the manual had been translated into Burmese and was ready for printing.

11. Semi-Annual Mill Seminars

The team began on-going, in-country oilseed processing seminars (see below under Training). Though only one was held in April 1988, it was originally planned that they would continue on a semi-annual basis. The CID was to take over responsibility for organizing the seminar. However, because the EOPD team left soon after completion of the first seminar, it is not certain that the responsibility has been taken up by the CID.

12. PIO/Cs for $1.4 Million

Specifications were written for $1.4 million of equipment, materials, and commodities for the oil mills and workshops. It took considerable study on the part of the EOPD team and the technical specialists in the EPE, Inc. home office to determine what equipment, materials and commodities to specify because the team was dealing with 20 to 40 year-old obsolete equipment in the mills plus a lack of parts and instructions or specifications manuals for this equipment. Further, the team had to be sure that the specifications written provided a solution that was practical for Burma.

SPECIAL OPPORTUNITIES PROJECTS

Magwe Oil Mill

Considerable team effort was extended to the new oil mill in Magwe, located in the Magwe Division which is the largest oilseed producing and processing Division in Burma. The Chairman of the division asked the EOPD team for help in getting the new mill started. This facility, which is not in the project, was purchased and installed by the Burmese in 1985. It opened in December of that year. No training or operating instructions were provided. The team trained the plant personnel in proper operating procedures and established a preventive maintenance program. As a result, they were able to increase production at this mill from 49,000 lbs./24 hr. day, 7-day week, to an interim capacity of 75,600 lbs./24 hr. day, 7-day week. This oil mill could process up to 112,000 lbs./24 hr. day, 7-day week, with additional training. Even more significant was the fact that due to the new maintenance program, plant breakdowns were reduced by more than 60%.

Use of Rice Kernel Hulls for Insulation

A plentiful natural resource is the rice kernel hull. The EOPD team found the hulls being used as insulation for the mill steam boiler pipes. Hulls were packaged in burlap bags which were then placed around the pipes. This was not a very efficient method of insulating the pipes, so the team experimented with a new process at the mill in Mandalay. There the hulls were made into slabs using rice paste to bind the hulls together. The slabs were then moulded onto the pipes, producing a much better insulating material as shown by the initial testing which recorded a low heat conductivity. The concept was still in the experimental stages at the time the EOPD project was terminated.

Laboratory Analysis of the Edible Oil and Pressed Cake

Unused laboratory equipment designed for oil analysis was discovered in Mandalay. The management of the oil mill in Mandalay provided the room to set up a laboratory using this equipment. It was assembled, and the technicians were taught its use and effectiveness in production and quality control of edible oil. At a later date when the U.S. laboratory equipment arrived, a laboratory for the analysis of edible oil was to be installed at the Prome oil mill.

II B.2. WORKSHOPS

Four workshops were renovated and provided with machinery and raw materials. Their technicians received training in new skills. The participating workshops were:

- Pegu, located in Prome Division, Pegu Syndicate
- Meiktila, located in Meiktila Division, Meiktila Syndicate
- Naung Yoe, located in Yennengyuong Division, Magwe Syndicate
- Sein Pan, located in Mandalay Division, Mandalay Syndicate

The main job of these workshops is to repair cars, trucks, and buses. Some of the workshops have worked with foreign aid projects in the past. Some of their skills are highly developed, particularly in the area of cast iron foundry work. Before 1962 these workshops did make parts for the oil mills but since that time, as far as the EOPD team could discern, none of the workshops had made any parts for the oil mills. Naung Yoe and Sein Pan had made expellers before the 1962 coup.

Pegu Workshop

This workshop is owned and operated by the syndicate of Pegu which has a direct association with the MOC. It is a true socialist cooperative, the only one of its kind in the project. It is located 40 miles from Rangoon and consists of a machine shop and foundry. It operates and maintains the Pegu bus line to Rangoon and owns about 60 rebuilt buses. The workshop has a high debt/asset ratio and suffers from poor leadership due to the recent deaths of the manager and the assistant manager. The skills level at this workshop is low. Only one oil mill, a private one, is located in Pegu. The next nearest mill is the one at Prome, 170 miles away. That mill is on the fringes of the oilseed producing area.

Meiktila Workshop

This workshop is almost completely autonomous from the MOC and is operated as a private enterprise shop. The skills level is high. The workshop is now located in a new facility situated outside the city where it houses a machine shop, foundry, and a special truck body shop. Most of its income comes from the rebuilding of trucks and other vehicles. The shop is well-managed and organized. Workers are very cooperative and anxious to work with the EOPD project. The workshop is deeply in debt, perhaps due both to the observed low volume of business and to the costs incurred as a result of being in a new facility. The workshop is located in the heart of the oilseed producing areas and is about 285 miles from Rangoon.

Naung Yoe Workshop

The workshop is a cooperative in name only. It operates as a private enterprise. It is old but has many new machines. There is a machine shop, foundry, truck body shop and a special division for making machinery for the rice and oil mills. The skills level of the labor force is very high in many areas, including such technical skills as a graduate metallurgist and a mechanical engineer. The workforce was mostly trained by the local technical high school and junior college. The management is highly trained and innovative. This is a successful operation judging from its high level of business activity.

Sein Pan Workshop

This "cooperative workshop" actually consists of fifty individual private enterprises. The only central workshop facility is an office compound. The chairman of this workshop is highly motivated and an exceptional entrepreneur.

The EOPD team had high hopes for this workshop because of its collective skills, but upon closer investigation it was found that this particular workshop was not structured to receive the kind of aid offered by the EOPD project due primarily to the fact that it houses a variety of operations. Most are workshops. Some are retail outlets which, for example, sell mill products or make specially requested items like pumps. In order for this particular workshop to receive project aid, the EOPD team did some re-formating of the workshop's structure. It recommended the establishment of a central, temporary facility in the main office compound where the EOPD team could then conduct its on-the-job training activities. To prepare for that eventuality, the team conducted a needs assessment and a beginning was made in delineating what training activities would take place and what equipment and supplies would be needed for this training.

WORKSHOP CONSTRAINTS

There were few constraints in working with the workshops. The technicians are highly capable and their enthusiasm, cooperation and participation in the project were of high quality. The following constraints rank equal in importance.

Electric Power. There were frequent power outages. When there was power, it often was not steady enough for the machines that

depend on electricity. This situation can seriously affect the overall, long-term operation of a machine.

Insufficient Supplies of Local Raw Materials. These were not available for purchase at "Official" rates. All of the raw materials not imported by the project had to be purchased on the black market.

WORKSHOP ACCOMPLISHMENTS

There are several workshop accomplishments. Of these, two stand out: the development of a chill cast iron alloy expeller "worm" and collar, and the re-design and re-fabrication of the expeller cage bars. The rest of the accomplishments either made these two major ones possible, or were, themselves, made possible as a result of the two major ones.

1. Development of New Chill Cast Iron Alloy Expeller Worms and Worm Collars

A new iron chill mould was devised for making expeller worms and collars and a method of steel chilling these expeller parts was developed. A new design, new tolerances and new specifications were made for the chill mould based on EOPD team experience in the field. A major breakthrough was made in the development of chilled cast iron wear parts thus further promoting Burmese self-sufficiency. This achievement was vital to the success of the project because steels normally used for these parts were not available in Burma. These new parts were standardized as much as possible in order to eliminate the necessity of hand-making each part to suit a specific need.

The EOPD project developed a unique solution to the problem of non-availability in Burma of alloy materials. A "master ingot" strategy was developed. From the U.S., 2,240 lbs. of the alloy have been ordered but are now on hold due to project termination. The master ingot contains a mixture of chrome, nickel, and other metals. Each ingot will be diluted with gray iron in the Burmese foundries at a ratio of about 100:1. Workshop personnel have been trained to work with the master ingots. Once this is done with all the imported ingots, 16,000 expeller worms can be made. Since the project mills use about 1,000 worms per year, the alloy made in the workshops from the master ingot shipment should last about sixteen (16) years.

This alloy has two important characteristics: it is recyclable and it is inexpensive in its diluted form. The master ingot will cost US$9.00/lb., delivered CIF Burma. By diluting the master ingot with iron, the cost addition will be US$0.09/lb. above the normal

Burmese gray iron cost/lb. Thus, the cost of the cast iron alloy in Burma will be about US$0.58/lb., or an increase in cost of about 20% over present Burmese plain cast iron. The cost of recycled alloy iron is unknown. A program could be developed by the workshops where an oil mill would pay only for costs of the new materials and labor used, plus overhead and profit. The recycled alloy could then be credited to the mill's account.

The current cost to an oil mill for open black market steel parts is about US$150 for a typical expeller worm. The actual cost of the new cast part, made from the master ingot, is about US$20. The locally made steel part does not properly fit and wears out in only a few weeks compared to the EOPD project part made with the chill cast iron alloy which has been tested through actual use in the mills, has been shown to last approximately six months, and thus has proved its superiority.

The alloy made from the master ingot is tough, hard (after heat treatment), and machinable in the unhardened state. The chrome and nickel provide these attributes. The EOPD team created the conditions for making improved expeller parts and came up with a product that has a toughness 7 to 10 times greater than plain cast gray iron. In compression it nearly equals steel. The team proved it is possible to make an alloy iron and that the alloy part can be machined. The team proved that it is possible to harden the part in the workshops. To date, the physical tests conducted on the parts are very encouraging.

The EOPD team was to work out the initial plan for distributing the master ingots, but, though ordered, the ingots had not arrived in Burma at the time of project termination. There is storage space for the ingots in the workshops. As stated above, the issue of how the workshops are to finance the purchase of this material has never been resolved.

2. New Method for Making Expeller Cage Bars

Through on-the-job training and use of a short-term consultant, the methods of heat-treatment and carburization (used to improve steel) were taught, and the design and manufacture of cage bars from WWII scrap steel was modified and improved.

Cage bars are an important wear part in the expeller. When the bars are assembled in a heavy metal frame around the expeller shaft, this provides drainage for the oil being pressed from the expeller.

The bars were redesigned by the EOPD team to facilitate manufacture in the same small foundries that can produce the pressing worms. Expeller cage bars must be made from steel. Because there is very little steel produced in Burma, the new parts are made from old WWII truck springs. The quality and chemistry of these re-cycled steel springs is unknown. To utilize these scrap springs, the team designed and built a special rolling machine and die. The truck spring is heated until it is white hot and rolled in this machine until it is about the size required. It is air cooled so it will be soft and machinable. It is then machined to the exact shape of a cage bar. Through heat-treatment and carburization, the bars are given the hardness needed for effective wear in the expeller. The life of these cage bars is about 6 months compared to the usual 3 to 4 weeks of the parts previously used. The bars now produced are equal in quality to the best in the world. Using the method developed by the EOPD team, expeller bars can be produced from scrap steel irrespective of the quality of that steel.

There is also a very significant economic advantage to the introduction of these redesigned wear parts in that together with the ease of manufacture and the longer working life of the components, the cost of the parts was reduced by at least 50%. Furtnermore, tne parts are totally re-cyclable when removed from the expeller for replacement.

3. Mass Production Techniques

A major problem faced by the EOPD team was teaching the workshops to produce many copies of a particular part so that each copy had exactly the same specifications. Historically the worksnops could produce only one to six items at a time. This had to be improved upon since the project requires a minimum of 40,000 expeller cage bars and 1,000 expeller worms to be replaced annually. This problem of repeating specifications exactly, so that mass production of one item can be achieved, is generally solved through the use of special jigs and fixtures which control the dimensions of each part.

Workshop technicians were taught how to use jigs and fixtures so that they could produce multiple copies of a part to specification.

4. Teaching of New Techniques Used in Working with Steel and Iron

All workshops have been taught how to do heat treating, carburizing, quenching, and normalizing when working with either steel or cast iron (see Glossary). These are basic techniques used in foundries that work with steel and cast iron. For the most part, these techniques were unknown in Burma before the arrival of the EOPD

team. Knowledge and application of these techniques is necessary in order for the foundries in the workshops to be able to produce the newly designed parts they developed in conjunction with the EOPD project.

5. Introduction of Modern Quality Control and Testing Instruments

Technicians received training in the operation and use of an optical pyrometer which is a device to measure the temperatures in the furnaces. They were also trained in the operation and use of a hardness tester which is used for quality control. Only one of each instrument was available for the training which took place at each workshop. These instruments are now on order for each workshop.

6. Design of a New Machine Shop and Foundry at Sein Pan

A new machine shop and foundry were designed by the EOPD team because this unique workshop of 50 or so individual enterprises (see description above) did not have a central location where the EOPD team could conduct on-the-job training such as was being given to the other project workshops. Considerable team effort was expended in design activities (Appendix I), but as of September 1988, no commodities were ordered although renovation of the building to house the shop and foundry had begun in April of 1988.

7. Design of a Furnace Using Waste Products for Fuel

One of the objectives of the metallurgical seminar of January-February 1988 was to "design, build and operate a heat-treating and carburization furnace using local solid fuel (i.e., sawdust, petroleum coke) and natural gas" (Appendix F). This was done and a furnace was built using sawdust as the primary fuel.

II.B.3. TRAINING

The training component of the EOPD project consisted of formal training overseas involving work for a graduate degree, the taking of graduate/special courses without obtaining a degree, and observation tours. Less formal training was done in Burma in the form of seminars conducted by short-term consultants and on-the-job training done at the worksite.

TRAINING CONSTRAINTS

The following were the major constraints in this portion of the project:

Lack of Staff for Training and Counterpart Positions. To restate one of the overall project constraints discussed above, staffing problems existed in three areas. The SRUB Project Manager and the Director General for the EOPD were not with the project at full-time status. At another level, the failure of the MOC to expand its staff meant that the EOPD team members did not get counterparts. EOPD counterparts would have had to be new hires for the MOC and MOC did not hire new people. Everyone already working for the MOC already had a job and thus was not available for EOPD project work. Finally, for the EOPD to fulfill its obligation to send candidates for training and for it to staff the new laboratories and the upgraded technical library, the MOC had to both approve training candidates and, again, to expand its staff, in effect hiring new people who would then work for the EOPD. What happened was that selection of training candidates was slow and MOC staff expansion did not take place as anticipated by the PP of the EOPD.

Selection of International Training Participants. The Government has a very cumbersome and elaborate system for selecting participants for overseas training. One consideration desired by the Burmese is that participants spend at least 90 days overseas which then entitles them to certain benefits upon their return. There also is a scarcity of Burmese who are sufficiently fluent in English to benefit from U.S. training. The selection committee managed to approve one small group to attend courses in the U.S. However, the MOC had not started the selection process for the remaining long-term and short-term participants as of the time of the evacuation of the EOPD team.

Short-Term Consultants. Thirty-six person-months of short-term assistance were provided for in the project. The SRUB set as a requirement that at least two candidates for each position be proposed for review by a high level committee. Although candidates were proposed by ACDI and EPE in two rounds, only three person-months of the twelve allowed for the project were approved. This, in effect, slowed down on-the-job training in Burma.

TRAINING ACCOMPLISHMENTS

1. In-Country Seminars Conducted by Short-Term Consultants

Metallurgical Seminar for the Workshops

A ten-day metallurgical seminar was held in January 1988 under the direction of project short-term consultant, Dr. Peter Weiser, metallurgist (Appendix F). The seminar was the catalyst that brought together team expertise, local materials for manufacturing parts, and the knowledge needed to design and manufacture new parts that would provide superior performance to those currently in use. The seminar covered formal lectures and hands-on training in foundry and machine shop work. As a result of this seminar, the breakthrough was made that enabled the EOPD team and workshop technicians to develop the chill cast iron alloy for making the improved, stronger and cheaper expeller worms.

Oil Mill Seminar for Mill Managers

The EOPD team plan was to establish semi-annual, nationwide oil seed processing seminars of 3 to 5 days. The first seminar was a great success and the MOC approved the continuation of these seminars in the future. The mechanism for continuing the seminars was to be set up by the EOPD team in conjunction with the MOC but because of project termination soon after the end of this seminar, that mechanism was not worked out.

The first seminar was held in April 1988 with more than sixty participants from 19 oil mills. The primary goal was to provide information and data on the activities of the EOPD project. The primary speakers were oil mill managers and laboratory technicians since it was felt they could most persuasively speak about the changes and positive results of the EOPD project activities which they themselves had been experiencing at their various establishments.

The seminar was designed for mill managers, the people in charge of overall mill operation. Besides learning about the EOPD project, they were to exchange information on their work. From this exchange the EOPD team hoped to set up national guidelines, to be followed by all mills, on how to procure seed and sell the products produced from the oil mills, i.e., the oil and the oilseed cake. The EOPD team had discovered that there were no national standards for grading the seed brought to a mill and paying the farmer according to the quality of the seed delivered. Nor was there any standard that had to be maintained for the pressed oil and oilseed cake. Through the device of these seminars, the project team wanted to set up standards to be followed on a national basis. It was hoped that the method of seed grading that would be adopted would be the one in use by the U.S. Peanut Growers Association. In addition to the issue of standards, the seminar dealt with technical issues such as boiler repairs and economies of fuel savings.

2. Long-Term Training Overseas

This portion of the training activity was the responsibility of the Office of International Training, AID/W. Two long-term trainees completed their training at Texas A & M. They specialized in engineering for edible oil extraction and processing. They returned to Burma in July and were assigned as counterparts to the EOPD team. By this time, however, team activities were considerably reduced so the trainees never worked with the team members. The team had made plans for training of an additional twelve students but the MOC delayed and had not started the selection process at the time of project termination.

3. Short-Term Training Overseas

Eight short-term trainees completed training courses in the U.S. and have returned and are in place in the MOC. These trainees have been assigned to work with the EOPD exclusively. The post-training evaluation by the team was very encouraging. It showed that these students now more thoroughly understand the project and the methods to be employed to meet project goals.

The universities attended were the University of New Hampshire, the University of Minnesota and the University of Wisconsin. Skill areas covered in training were data collection, analysis, marketing, project design, macro and sector planning for those trainees from the Planning Division of the Cooperative Department, MOC. One change in field of study was made from computer programming to computer maintenance and repair. For trainees from the Cottage Industries Department, MOC, the training skill areas were in solvent operations, instrumentation, metallurgy, nutrition, and quality control.

4. Overseas Observation Tours

Ten person-months of observation tours were completed. Five people took tours to the U.S. and five people toured the Federal Republic of Germany. These tours were very successful. They had been designed to maximize benefits to the project and the nature of participant selection was such that it ensured each participant would be making a contribution, at some level, to the EOPD project. Sixty percent of the observation tour participants actually work with the EOPD team.

Three factories were visited in Germany. The primary goal of the tour was to show the Burmese participants how a modern workshop makes expeller parts. Participants observed the making of all the parts

used in an expeller, had a training session at the Krupp factory, and from the Krupp workers received a promise of help in making special parts for the old machines in Burma that originally came from Krupp or were modelled on the Krupp expeller. Three participants on the tour to Germany were workshop machinists or metallurgists. Two other participants were from CID and had not been acquainted with the EOPD. As a result of the tour they now know what the project is trying to do and have pledged their help in getting the project to reach its goals.

5. Short-Term Consultants for In-Country Training

The project implementation plan written by the EOPD team specified three types of short-term consultants:

* Field technicians such as metallurgists and boiler experts who would further field applications of their expertise;

* Needs assessment consultants to evaluate the MOC and its relevant subunits to determine training needs;

* In-country trainers for formal training of MOC subunit staffs.

The implementation plan specified the number of consultant person-months per year: 14 in 1987, 10 in 1988, 5 in 1989, and 7 in 1990. By the time the project was terminated in September 1988, only two person-months of short-term consultancies had been utilized: Dr. Weiser, metallurgist, and Mr. Strop, laboratory consultant. The third consultant approved by the MOC, Mr. John Butler, boiler specialist, had to cancel his consultancy due to a heart problem identified during a physical examination.

6. On-the-Job Training

Because of the slow MOC approval process, the EOPD team could not bring in outside consultants to provide technical support and necessary training. The project team thus had to depend on its own resources and experience to carry out the training required by the demands of the rehabilitation process.

On-the-job training was conducted for the purpose of teaching technicians how to manufacture replacement parts for edible oil expeller press machines. Training was conducted at the worksites-the cooperative workshops and the oil mills--in casting methods, the operation of milling, drilling, and grinding machines, quality control practices, inventory control, machine shop job scheduling

methods, blueprint reading and interpretation, the use of measuring tools, and the making and use of jigs and fixtures.

II.B.4. LABORATORY

The fourth project component was the establishment of laboratory facilities at oilmills and the CID.

When the EOPD team arrived in Burma, it found that half of the project commodities for the laboratories had been ordered by the procurement agent but that the ordering of the balance of the equipment and commodities was to be the responsibility of the team. The EOPD project team developed specifications for orders of a total of $121,000 in laboratory equipment for the Cottage Industries Department (CID), which is the MOC's headquarters for oil mill data collection, statistical analysis, and quality control activities. The team was also to design, construct, and train technicians in the operation of a new laboratory containing a bench solvent extraction pilot plant to be used for research on edible oils.

LABORATORY CONSTRAINTS

The following constraints are of equal importance.

Electric Power. As with the workshops, there were frequent power outages which affect the long-term operation of lab equipment. There were also problems with vacillating current.

Lack of Staff. There were not enough people to operate the labs.

Data Collection. There was inadequate communication with the oil mills as far as obtaining production data; no data collection system or protocols are in place that would specify what data is to be collected and how the collection is to be conducted.

Financial Resources. As stated above, mills and workshops have problems setting up financing for purchasing EOPD project resources.

LABORATORY ACCOMPLISHMENTS

1. Laboratory at the Innovation Division, C.I.D.

Equipment valued at $121,000 was procured, installed in the Innovation Division of the CID in May 1988, and technicians for the lab were trained by the EOPD team in the use of the new equipment. On a regular basis, this "mother" lab can now test edible oils and

expeller oilseed cake. Samples were typically collected by the EOPD team in the field from the various oil mills. It was the intention of the project team to set up a system whereby these samples would be sent regularly. Major problems to be overcome are distance, a poor telecommunications system, and one level of the process (the mill technicians) not understanding the needs of the other level (the CID lab). The project was terminated before a regularized system of supplying samples could be set up.

2. Satellite Laboratories

Twelve satellite laboratories are in the process of being installed in EOPD project oil mills. Three labs have already been completed in project mills and are fully functional. As a result of EOPD team efforts, the CID "mother" lab is now in a position to provide training in quality control for the labs in the fifteen oil mills. The Burmese team leader selected for this job was trained by the project in the U.S. through the short-term training activity.

3. Replacement Strategy Proposed for Bench Solvent Plant

A bench solvent plant was designed by the TAT but it was not installed because proper facilities were not available at the CID. Also, it was finally determined, in consultation with USAID/Burma, that such a plant was not appropriate for Burma at this time.

The plan to manufacture a bench solvent plant was replaced with another idea. It was believed by the team that a more appropriate approach to solving the edible oil quality problem would be to design and build a small, semi-commercial edible oil refining plant. This plant would remove the impurities in the oils and could be used to do research and development for the edible oil industry. Such a plant would be fully capable of refining the oil from any mill. A refinery plant of this size is, to some extent, pre-fabricated and thus is not as costly as a solvent extraction plant. Though approved by the MOC, this idea was put on hold. In the event of project resumption, this idea should be further explored.

II.B.5. LIBRARY Technical texts (500 volumes) directly related to edible oils and oilseeds were to be ordered from U.S. sources, along with appropriate periodicals and journals. A librarian was to be trained, a file card index system established, and abstracts prepared for the technical library housed in the CID Training and Education Division.

LIBRARY CONSTRAINTS

Location. The present library facility is located at the North Okalapa CID which is about twelve miles from the MOC central office. This inconvenient location does not facilitate use of the library by those MOC staff who need access to a technical library.

Librarian. The CID has not expanded staff as envisioned so there is no librarian for the project to train.

Facility Size. The present housing for the library is too small. There is no other space available at this time.

Technical Texts. Many of the reference books and texts needed to establish a comprehensive library are no longer in print. Special procurement services are required to obtain these materials.

Short-Term Consultants. The MOC delayed the approval of a library consultant so the project was not able to do a needs assessment or to train a librarian.

LIBRARY ACCOMPLISHMENTS

1. Coordination with Other Development Projects

The EOPD team organized a program with the Federal Republic of Germany and the International Labor Organization (ILO) projects operating in Burma to prevent duplication of library efforts and expenditures and to maximize the combined resources of the projects. A coordinating committee was established and was co-chaired by project team members Perry and Zaleski and Dr. Prue of the CID. Selection of library short-term consultants was based on the recommendations of this committee. However, none of the consultants had been approved by MOC by the project termination date.

2. Materials

Over 500 reference books, journals and periodicals were ordered. Over 300 materials for training in edible oil production and for operating a library were ordered. These include items such as paper, file cabinets, audio-visual equipment, and cataloguing materials. They are to be housed in the technical library. As of September 1988, none of the materials ordered had arrived in Burma.

III. PROJECT RESUMPTION

The EOPD project has made a number of unique and important contributions to improving the production of edible oil in Burma. This was done primarily by building on existing local expertise supplemented by on-the-job training, and by using materials, most of which are available in Burma, and processes that are appropriate to the Burmese situation. Within the short period of approximately one year, three technical breakthroughs were made which resulted in a considerable increase in the production of oil (and cake) and in cost savings in mill operation. The EOPD team and Burmese technical staff produced:

-- new and longer-wearing expeller worm and collar parts from chill cast iron alloy;
-- a re-designed expeller shaft arrangement more suitable to Burmese oil pressing conditions; and
-- a re-designed and longer-wearing expeller cage bar.

These technical advances have not yet been installed in all the mills the project worked with. In order not to lose the tremendous production and quality advantages which they and other project achievements represent, the technical work of the project must be continued and the successes of the project consolidated. This would be done in the re-start of the EOPD project, continuing basically in the same format as originally planned.

Two processes are involved in project re-start. The first is to determine where things stood as of September 1988 when the project technical assistance team was evacuated. The second is to engage in steps to get project inputs in place so that the re-start can begin?

III.A. Situation at time of Evaculation: Commodities, Excess Property, Household Effects and Vehicles

All of these were left in Burma and to some extent their disposition is unknown.

Project commodities, procurement and shipping were the responsibility of RONCO which has written a final report on the EOPD commodities that provides information on their disposition. The report delineates the status of each commodity. Not all commodities had been shipped as of September 1988. Some are still in storage at the RONCO warehouse.

Excess property was shipped by RONCO as of March 31, 1988, and it is assumed that it has arrived in Rangoon port. RONCO received a

telex from AID/Rangoon that containers had arrived, some in a damaged state. There has been no further communication since then.

An example of the value of commodities not yet shipped is the five boilers custom built for use in the oil mills of Burma. They are in storage in RONCO's warehouse. Because of their unique design, these boilers cannot be used elsewhere and unless they are used in an EOPD re-start, they can only be sold as scrap. This would be a waste. It would be desirable to find a way to deliver the boilers to the five project mills for which they are intended.

Another example is the equipment for the quality control labs. Equipment for twelve labs in the project target mills has been ordered and is in storage.

Household effects and project vehicles were all left in Burma. It is assumed that the SRUB took possession of them at the time of team evacuation.

III.B. Situation at time of Evaculation: The Five Project Activities

1. Oil Mills: The EOPD team had begun rehabilitation work on five of the fifteen project targeted oil mills, plus work on a new mill not in the project's purview (Appendices A through E). The "Burma Design" proto-type expeller worm arrangement and cage bars have been built but, due to team evacuation, have not yet been installed. Installation was to take place soon at all the mills. Introduction of sanitation practices and cleaning and repair of oil storage drums had begun at all mills. The concepts and practices of periodic machine maintenance, safety measures, and better managerial techniques had been introduced. All of these procedures need reinforcement activities.

2. Workshops: Technicians from the four project workshops have participated in metallurgical seminars where new techniques for working with steel and iron were introduced into the Burmese foundry repertoire of skills. Workshop technicians have worked with EOPD team members in designing and building a new expeller worm, worm collar, and cage bar that is more durable than the parts previously used. They have been taught mass production techniques and machining. The workshops have been partially upgraded and are now awaiting delivery of commodities and fabrication parts that will further that upgrading. They are at the point where they can begin to make the replacement parts for the mills.

3. Training: Slowness in getting SRUB approval both for overseas training candidates and for short-term consultants to do in-country

training has hampered this portion of the project. In addition, the MOC failed to expand its staff which resulted in there not being candidates for training for positions in the laboratories and in the centrally located technical library.

4. Laboratory: A central laboratory has been upgraded in the CID in the Innovation Division and technicians trained in the use of new equipment. Labs have been set up in three of the fifteen project target mills. Equipment and supplies for twelve other labs, and some replacement material for the three labs already set up, have been ordered.

5. Library: Materials were ordered but the order has been cancelled. It has not been possible to find a candidate to train for the position of technical librarian.

III.C. Tasks Preliminary to a Start-Up Effort

For the EOPD project to re-start, the following steps are crucial.

1. Locate and inventory project commodities, excess property, household effects, and vehicles. The guiding questions here for all materials left in Burma are:
   - -- who is authorized to locate and inventory items?
   - -- where is an item?
   - -- who has control over it?
   - -- can the EOPD regain control over this item?

The next level of questions revolve around the re-started project:
   - -- what does the re-started project need?
   - -- which of the items that we have been able to regain in Burma can we use in the re-start?
   - -- what items are missing and need to be re-ordered?

2. Ordering new commodities and equipment.
   - -- what items are missing and need PIO/Cs?
   - -- who will do the writing of the PIO/Cs?
   - -- realistically, how long will it take for the new items to arrive?
   - -- what is the arrival schedule for the project team in relation to the arrival of the commodities and equipment?

3. Set up a new system for disbursement of project funds.
   - -- what entity will manage the system?
   - -- what is the disbursement mechanism?

-- how can a system be structured to make funds readily available to the project team?

4. Locate original project documents.
   -- where are the files, drawings, technical reference materials, etc. that were in the main office?
   -- can the project regain control over any of the remaining items?

III.D. Specific Recommendations

1. The EOPD base of operations should be moved to Mandalay. The majority of the target oil mills are in this region as are the workshops. Access is easiest from a base in Mandalay. It is also considerably easier to receive travel permission from the responsible official in this region. The participation of the Burmese people in this region has been of a high level.

2. No further equipment or commodities be supplied through the project except for a few expeller parts, bearings, gears and other items judged essential for the continuation of the rehabilitation effort.

3. Training should be limited to long-term and short-term studies in the U.S. Contingency could be provided for two observation tours in case some special need is identified after the project resumes. However, it generally is felt unnecessary to plan on observation trips.

4. Short-term consultants should be limited to about six person-months for the balance of the project. The work of these consultants should be directly related to the support of the oil mills, workshops, and management services in the Planning Department. It is suggested that areas of expertise be electrical installation, material handling, machining practices, and practical metallurgy.

APPENDIX A

A CASE STUDY OF CHAN MYA THAZI OIL MILL - MANDALAY
Derrick A. Burgess

This report details findings at the Chan Mya Thazi oil mill following a preliminary remedial maintenance program.

The Processing Cost Analysis for Fiscal 1985-1986

To process 100 viss of groundnut costs 24.24 kyat. This figure does not include the cost of damage, seed losses (shrink) or depreciation. Cost breakdown is as follows:

Direct Costs

Description	Percent	Kyat
Labor and Admin.	52.90%	88,069.00
Maintenance and Grease	17.83%	29,683.92
Meter Charge (Elec.)	5.05%	8,407.39
Sawdust	2.33%	3,881.15
Transport	3.64%	6,063.27
General Expense	8.23%	13,708.99
Tax Registration	0.69%	1,151.28
Insurance	9.33%	15,567.38
TOTAL	**100.00%**	**166,853.00**

The processing machinery consists of two production units: the first uses two China expellers, and the second uses one Alpha and two Krupp expellers. For comparison purposes, the processing cost has been divided between the two units.

The average production of the number (1) unit was 882 viss of groundnut per shift and the residual oil in the cake was 10-11% (in 1986).

The two China machines in this unit were brought back to specification in wear parts, i.e., pressing worms, and the main shaft speed was increased to 12 r.p.m. The cooker drive was maintained at the original speed. The processing method was changed from the three-press system to the two-press system.

As a result of the modifications, there was an increase in production of 2,572 viss per shift and a reduction in residual oil in the cake to 7.0% (average). This represents an increase in edible oil production from 343 viss/8 hour shift to 1,073 viss/8 hours shift.

There was a reduction in processing cost of oil: 24.24/2 = 12.24 x 8.82 = 108 kyat per 8-hour shift. This results in about a 68% reduction in operating cost/ton processed. This kind of operating cost reduction and production increase has resulted in converting this oil mill from one losing 60,000 kyat per year to one making a profit of more than 60,000 kyat yearly.

This oil mill has been cleaned, painted, and four of the five expellers have been rebuilt. The last expeller is awaiting parts from the U.S. which are due to arrive in May 1988. New conveyors have been installed. Pits and openings have been cleaned and covered.

The oil mill has been converted from a 4- or 5-pass process to essentially a two-pass operation. The quality of the oilseed cake and oil has been improved. The production has increased more than 300%.

APPENDIX B

MEIKTILA OIL MILL, MEIKTILA
Status Report as of February 1988

Derrick A. Burgess

- The boiler and boiler room have been rebuilt.
- New concrete floors have been poured.
- New conveyors are in the process of being installed.
- Expeller shafts and parts are being manufactured in Burma.

As the result of maintenance work, the boiler has been re-certified. The oil mill press room is now in operating condition and is ready for rehabilitation work.

APPENDIX C

PROME OIL MILL, PROME
Status as of February 1988
David R. Zaleski

All engineering and design work has been completed. Parts are on order or in the process of being manufactured. This oil mill should be completed by mid-June 1988. Normally an oil mill of this size requires a boiler of about 15 BHp, but the present boiler is 3 BHp. A new boiler is being purchased.

Historical Background

The Prome Oil Mill is located in the Pegu Syndicate where insufficient oilseeds are grown. This oil mill has six expellers which were manufactured in 1968. Five of these six fabricated in eastern Europe and parts are unavailable.

After numerous planning meetings with the oil mill and the Syndicate, it was decided to rebuild only three expellers for now and relocate the other expellers. A new oil mill will be designed and put into operation by the team.

The remaining three expellers will be able to process all the oilseed grown in the Prome area with a design capacity of up to 10,000 MT annually. The present production rate is 1700 to 2200 MT/year.

Progress

Rehabilitation of this mill is scheduled for completion by mid-June 1988. One expeller is being completely rebuilt with project-designed parts manufactured in Burma. This expeller will be put into operation in early March 1988. The capacity of this expeller alone will exceed 3,000 MT/year. The residual oil content is expected to be high (15.0%) because the mill has insufficient boiler capacity. Therefore, it will be necessary to double press (versus the six passes presently used).

Because the capacity of the expeller will be so high, sufficient feed cannot be supplied with manual labor. Therefore, the EOPD team has designed and installed a continuous screw conveyor feed system. A new cooker has been designed by the team and is presently under construction. It will be installed during Phase II, to commence in April 1988.

The plant is presently being cleaned and painted. Conveyors are being covered. A PM system is being incorporated. The economic evaluations cannot be completed until the renovation of Phase I is completed, but the Team expects results similar to the Chan Mya Thazi oil mill in Mandalay.

APPENDIX D

MAGWE TOWNSHIP OIL MILL, MAGWE
Status as of February 1988

This relatively new oil mill has been plagued by minor problems many of which the team has helped overcome.

- Conversion from diesel to natural gas fired boiler. Modification and repair of controller.
- Design of oil screening tank to be approved and installed.
- Numerous recommendations as to modification of operating procedures.
- Incorporation of a PM system.
- Training in the new cooking techniques is still in progress.

APPENDIX E

MAGWE SYNDICATE OIL MILL, MAGWE

This oil mill consists of two imported expellers manufactured in the early 1950s. They were in very bad condition and the oil mill was shut down frequently for repairs.

This plant, while not yet completely renovated, is again in operation.

New parts are on order from the Naung Yoe workshop and the oil mill should be completed by mid-June 1988.

APPENDIX F

METALLURGICAL SEMINAR REPORT

MEETING DATE: January 25 - February 4, 1988

PARTICIPANTS: Dr. Peter Wieser, TDY Consultant, Metallurgist and University Instructor
Richard R. Perry, Team Leader/EOPD
David R. Zaleski, Master Mechanic/EOPD
Derrick A. Burgess, Master Mechanic/EOPD
Workshop staff: (44 participants) from the project workshops - Sein Pan, Meiktila, Naung Yoe and Pegu
MOC representatives
U Than Win (project counterpart)

LOCATIONS: The Seminar was held at the Meiktila workshop facilities for seven days and then in the Naung Yoe workshop for three additional days followed by a one-day short course in Pegu.

OBJECTIVES: The objectives of this metallurgical seminar were:

1) to produce expeller parts using mainly Burmese commodities and skills so that the workshops can be self sufficient in the production of those parts.

2) to introduce methods of heat treatment and carburization of certain materials so as to enhance the properties of the finished parts while using local resources.

3) to design, build and operate a heat treating and carburization furnace using local solid fuel (i.e., saw dust, petroleum coke) and natural gas.

4) to assist in the development of foundry techniques for the production of aluminum, bronze-brass and gray iron parts.

5) to introduce methods of molten metal innoculation.

6) to introduce the concept of quality control, its importance and the methods for achieving quality control in the production of machine parts.

7) to capitalize on existing foundry skills and to utilize local raw materials to maximize oil mill expeller operations.

8) to respond to local needs and questions concerning fundamental problems encountered in the workshops.

SUMMARY & CONCLUSION: The Seminar proved to be highly successful in reaching its primary objectives as shown:

- by producing Expeller parts of vastly superior qualities than those presently being used; these are equal in many respects to those parts made in other parts of the world.
- by designing and building a heat treating and carburization furnace using saw dust as a primary energy source.
- by the introduction of new methods of preparing superior sand molds so that the cast parts are improved and there are fewer rejects.
- by demonstrating new methods of casting aluminum.
- by demonstrating the need for and use of control equipment such as hardness testing and temperature controls.

Physical tests of the produced parts indicated superior qualities. Many of the produced parts have been placed into operation in expellers. The results of these tests will be reported when the parts wear out in about 6 or 7 months.

METALLURGICAL SEMINAR TESTS

Project participants first examined the foundry facility. The following equipment is now being used.

1. One (1) new heat treat furnace
2. One (1) small furnace used for heating of small parts 18" x 18" x 24"
3. One (1) medium furnace for heating larger sized pieces of work (2' x 3' x 8')
4. One (1) melt furnace, outfitted with air inlet manifold with about 30-40 viss coupola capacity

All furnaces are natural gas or bottle butane gas fired and are lined with silica (acid). There are no controls for air or gas.

First we carburized the cage barrel bars and got the hardness tester to work. The bars tested very well with some as hard as 63 Rc (hard enough to cut glass) both for low- and hi-carbon steel. The

procedure appears to be very effective. Next, we checked for temperature variation and after carburizing listed the hardness ranges. Most tested between and 25 Rc. We then heat-treated the bars to 1650 F and quenched them in salt. The hardness in all cases ranged from 53 to 63 Rc. Finally, we heated other bars to 1900 F. These tested at 63 Rc but were hardened all the way through, and were very brittle and extremely fine grained. Prior to the project no heat treatment was employed in Burma.

Next we heat treated and salt water quenched the worms with these results:

Carbon steel worms	47-48 Rc
Cast iron	30-35 Rc
Hi chrome (8%)	too hard, off Rc scale
Iron chrome low alloy	(0.4-1.4%) 65 Rc

Chrome and nickel variations - alloys will alter the machining quality of the heat treated parts but will have little effect on toughness which is 358,000 psi in compression compared to iron which is 48,000 psi and steel which will range from 100,000 psi to 400,000 psi depending upon which kind of steel and whether it was heat treated.

The project will import 2240 lbs. of a "Master Ingot" with chrome, 20% nickel, 10% manganese (balance iron). This will be diluted with gray iron at a ratio of 100:1 to produce about 16,000 worms. This alloy is recyclable. It is inexpensive in the diluted form. The master ingot will cost US $9.00/lb delivered CIF Burma. By diluting the ingot with iron, the cost addition will be US $0.09/lb above the normal Burmese gray iron cost. Thus the cost of material in Burma will be about US $0.58/lb or an increase in cost about 20% over present Burmese gray iron cost. The cost of recycled alloy iron is unknown.

A program could be developed by the workshops where the oil mill would pay for the costs of the materials, labor, fuel and machining, and any recycled material would be credited to the mill's account thus reducing the cost of the actual labor and the cost of the replaced materials.

The present cost to an oil mill for blackmarket steel parts is about 900 kyat for a typical press part. The actual cost of the new cast part is about 120 kyat. The steel part does not properly fit and lasts only a few weeks compared to the EOPD part which is now known to last about 6 months.

This iron alloy is tough, hard (after heat treatment) and machinable in the unhardened state. The chrome and nickel provide these attributes. Through testing we have found out that these parts are superior. The hardness depth varies due to lack of temperature controls at Naung Yoe but the minimum depth was 0.060". In ranges as low as 0.1% chrome and 0.1% nickel the conditions we want will be present. The toughness is 7-10 times greater than cast gray iron and in compression equal to steel.

The ideal composition has yet to be determined for our purposes. We proved we can make an alloy iron and that the alloy part can be machined. We proved that we can harden the part. To date, the physical tests are very encouraging.

The literature states that the presence of nickel aids machining (and finish) greatly and the chrome somehow acts independently as a eutectic and forms chrome carbides. Carbon combines with free graphite in the iron. Both are very hard.

Carburization of low carbon steel large pieces is not affected by the "packed system" used. The steel part only hardened to Rc 47-48. Due to the mass of this part, this is normal. These parts should be hardened in a molten salt bath (NaCN).

After quenching and before use, each worm should be stress relieved to about 600 F, then air cooled. This will soften the piece somewhat but remove casting and quenching stresses. This procedure may be important for these cast parts.

WORKSHOP SUMMARY

-- All workshops now know how to heat treat, carburize, quench and normalize parts of either steel or cast iron.

-- Even though only one workshop has natural gas and gas furnaces, the EOPD team designed, developed, built and tested a furnace to use solid fuel. The team also developed a solid fuel feed device by which some temperature control can be maintained.

-- The operation and use of an optical pyrometer was taught.

-- The necessity and use of a hardness tester was taught.

-- New cast iron alloy parts were developed.

-- New expeller cage barrel bars were made that are equal to the original manufacturer's specifications.

-- A new steel chill mold was produced for expeller worms.

-- A "Master Ingot" was developed for making cast iron alloy parts.

APPENDIX G

MEIKTILA WORKSHOP, MEIKTILA
Status as of February 1988

This workshop has been relocated to a new facility consisting of machine shop, truck and car repair shop, and foundry. The foundry was always capable of producing parts from recycled grey cast iron. It is now able to produce a variety of parts from a variety of steels and irons.

The EOPD team and the workshops now have completed a carburizing and heat treating furnace fired by sawdust (which is in bountiful supply and low cost).

The workshop now can anneal, heat treat, normalize, carburize, quench, harden and soften. They have also been shown how to reduce manganese dioxide to the metals which are used in special iron alloys.

A new metal testing laboratory is being designed and shall be completed prior to the end of the project.

APPENDIX H

NAUNG YOE WORKSHOP
Status as of February 1988

This workshop is among the most progressive in Burma. It has excellent support from the local university and a high quality technical high school. These two provide the labor pool for the workshop.

The foundry now has gas fired, heat treating, carburization and annealing furnaces. They are capable of casting grey iron, alloy irons, chilled cast irons and certain ferric or pleuritic and martensitic irons needed both by the oil mills and their recycled auto and truck industry. They are also able to make and cast babbitt bearings, bronze and brass parts. Recently, they were shown how to cast alloyed aluminum. They now can produce an aluminum heme dome piston (high tech) as well as Ni hard cast irons for irrigation pumps.

This workshop is presently being trained for mass production of expeller parts since the project requires a minimum of 30,000 cage bars and 1,000 expeller worms annually. Historically the Burma workshops can produce only 1-6 items at a time.

APPENDIX I

SEIN PAN WORKSHOP
Status as of February 1988

The Sein Pan workshop, located in near Mandalay, is a loose federation of about fifty private enterprise workshops operating on their own. Each has limited resources. However, under the collective umbrella of the cooperative society, many benefits may accrue. Ultimately, the collective workshop may be viewed as competitive to the individual shop.

At the present time, no cooperative facility exists at Sein Pan except for a headquarters office. While some new sites for a central workshop have been suggested, none have been approved.

In view of the circumstances, the EOPD team recommended that a temporary facility be established in the main office compound. It was thought that this could facilitate EOPD project training. Given the limitations of the project, it is impossible to provide hands-on training in all fifty of the member workshops.

This plan was presented to Sein Pan in January 1987. It was informally approved in November of 1987. At the time of presentation, the team provided a schematic drawing for a proposed workshop area.

In November 1987, the team was asked to provide a plan of the area, an architectural drawing of the building's foundry, office space, machine shop, weld shop and storage areas.
A comprehensive layout was provided even though such work is far above the scope of the EOPD project. Again, tacit approval was given to proceed with this plan and a request was made for the team to provide electrical drawings for the main electrical supply, specify the main transformer and predict maximum power requirements. Simultaneously, a needs assessment was made by the EOPD team.

Essentially, Sein Pan wants to incorporate natural and/or propane gas, heat treating, carburization and annealing furnaces, all to be designed and specified by the EOPD team.
It was determined that electrical furnaces are required for these purposes. A need also exists for an electrical coerces induction furnace for the recycling and casting of a large volume of scrap steel.

The assessment showed that Sein Pan will require physical testing and laboratory equipment for maintenance of some level of quality control, particularly in the area of cast steel products.

Finally, the EOPD team is to select, specify and assist in the procurement of all of the above as well as select, specify, and assist in procurement of essential machinery tools and supplies necessary for the founding, casting and machining of a wide variety of products, including expeller parts.

To date, all of the above services have been provided with the exception of architectural and civil designs.

APPENDIX J

MANDALAY ACTIVITY REPORT
(February 1987 - September 1988)
Derrick A. Burgess

FEBRUARY 1987

Arrived at post, Mandalay, from Rangoon, supervised renovation of living quarters at #9 of 68 between 32 and 33 Street. Supervised renovation of office and laboratory premises allocated by the Mandalay Division Syndicate Cooperative at the Chan Mya Thazi Oil Mill. Directed the installation of laboratory furniture and equipment, thus establishing the base of operations for the upper Burma section of the EOPD Project.

A mechanical survey of all the processing machinery and equipment--such as expellers, conveyors, elevators, edible oil pumps, filters, boiler, feed water pump and pipe work--was carried out at the Chan Mya Thazi Oil Mill. All this equipment was found to be in various stages of disrepair. In the case of the expellers, these had become dimensionally inefficient. The old expellers, i.e., Krupp and Alpha, have locally repaired transmission gearing which is subject to frequent mechanical failure.

MARCH 1987

The production parameters were recorded over a period of time and established as 36 to 40 bags containing 25 viss (900 lbs.) of seed processed per 8-hour shift through the two China expellers. Forty bags of seed were processed per 8-hour shift through the old Alpha and Krupp expellers. The residual oil in the pressed cake was 10 to 11%.

The economic profile of the mill operation was studied with U Sein Hla, the Oil Mill Manager and counterpart/Mandalay, to determine if profits from the operation would make the capital expenditures for rehabilitation feasible. It was found that income was derived from a processing charge of 30 kyat per 100 viss of seed processed for the member townships of the Cooperative. This is called "Toll Processing Charges." The profit from this income was approximately 3 kyat per 100 viss processed and the annual processing volume was approximately 60,000 viss of seed.

Additional laboratory equipment and chemicals were obtained by U Sein Hla from the Maymyo Milk Factory. These permitted the EOPD team to begin analysis of seed and pressed cake samples in order to

determine the oil content of the samples and the production efficiency of the cooperative and private mills in the upper Burma area.

Meetings and discussions were held with committee members of the Sein Pan Workshop Cooperative with regard to any progress that they had made toward establishing a site for the proposed central workshop complex. It was found after a visit to a proposed site that the committee generally was dissatisfied with the site because of a very rough road access and the existence of a cemetery in the center of it. Another township had been approached for an alternative site but the committee expected it would take approximately 9 months for a decision to be reached. In response, the EOPD team produced a proposal and a sketch of a machine shop to house the machine tools that are to be provided through the EOPD project. The shop would be located on the existing site of the Workshop Cooperative headquarters. The committee agreed to pursue this concept and obtain the necessary permission to erect a building of the proposed dimensions.

An order was placed with the Cooperative Members Workshop to supply various V-belts and flat-belt pulleys to begin the first stage of rehabilitation to increase the production of edible oil at the Chan Mya Thazi Oil Mill.

New bearings were fitted to the old expeller drive shaft and feed end bearings were fitted to the China expellers. New screw flight sections were fitted to the down feeder. The spur and bevel gears were inspected on the China expellers and found to be in excellent condition after five years of operation.

Discussion with U Sein Hla on process changes took place and were approved. Visits were made to three private oil mills in Mandalay to explore the possibility of rehabilitating these mills.

1) **DANA BALA** - has 4 x 33" expellers.
2) **AUNG MYAN MAR MYINT** - this mill has six expellers but is not operational due to family problems; it periodically does toll crushing for various townships.
3) **THUKHA ADANA** - it also has 4 x 33" expellers; it was not interested in increased production but would like to obtain worm gear boxes and thrust bearings.

The laboratory facilities were offered to these mills should they wish to analyze their raw seed and press cake products. An economic discussion took place with these oil mill owners and it was

determined that keeping profitability to an acceptable level was their main concern.

Visitors to the Mandalay EOPD:

Mr. Dennis Weller, Project Officer
U Than Htaik, Project Director, Cottage Industries Dept.
Mr. Richard R. Perry, Team Leader, EOPD
U Aung Win, Temporary Counterpart

APRIL 1987

End of sesame processing. All expellers dismantled for rebuilding of wear parts in preparation for groundnut processing.

Power transmission gear box removed from Alpna expeller and examined. It was approximately 50% worn. This gear box is of the worm wheel and worm shaft design and cannot be repaired in Burma. Direct replacement parts or a complete gear box are required via the EOPD project. It is also identical to the gear box on the English Rosedown expeller. It was later determined that these "Rosedown" expellers are actually copies made in India.

I gave a lecture on the edible oil project to cooperative representatives from various townships at the Mandalay Training College at the request of U Ye Myint, the College Director.

The MOC mill survey team arrived from Rangoon. I explained the processing operation to them and directed their mechanical economic survey.

Many mechanical breakdowns, such as seized bearings, were experienced this month which provided the opportunity to advise on lubricating maintenance and protection from abrasive contaminants.

The 12" diameter pulleys were received from one of the Sein Pan workshops and fitted to the China expeller drive motors. This increased the main shaft revolutions to 12 rpm from 8 rpm.

The #2 Krupp expeller was dismantled and the feed end bearing housing was realigned. This malalignment had been causing the main shaft to fracture.

The processing method was modified on the China expellers. Together with the main shaft increase in speed, this increased production from 40 x 25 viss bags of seed to 105 x 25 viss bags in 8 hours.

Visits to the private oil mills in Mandalay were made to discuss possible process changes and to make arrangements for a demonstration by myself and U Sein Hla.

I visited Rangoon EOPD for project and implementation plan discussions.

Visitors to the Mandalay EOPD were:

The MOC survey team.

MAY 1987

Carried out processing changes on an Alpha and two Krupp expellers which increased production from 40 bags per shift to 80 bags per 8-hour shift. Doing regular analysis of raw seed and expeller cake now. Residual oils in expeller cake from both systems are now down to 7-8%.

Mandalay private mill owners visited Chan Mya Thazi Oil Mill and laboratory. I discussed processing and analysis methods. They were very concerned about increased profitability.

Visited Dana Bala Oil Mill. Observed processing method and took samples for analysis. Also at a later date demonstrated two-pass processing for an 8-hour period. I provided mill owners with profitability analysis and analysis of products but no further interest was shown.

Installed steam condensate recovery system in Chan Mya Thazi Oil Mill. This will increase efficiency of boiler and reduce consumption of fuel.

Visited Sagaing Syndicate Cooperative Oil Mill. This is a recent installation commissioned in January 1987 and has been processing since October 1986. Measured production, method of operation and took samples of raw seed and cake for analysis. Had discussions with the Syndicate Chairman about the EOPD Project and our achievements at the Chan Mya Thazi Oil Mill. He gave permission to order pulleys and other equipment to improve processing rate. His mill has three China expellers.

Visited the Sein Pan Cooperative Workshop Chairman, U Chit Pe, to order V-belt pulleys for Sagaing Oil Mill. Delivery next month.

Discussed the cost of producing groundnut with U Kyaw at Chan Mya Thazi Oil Mill and discovered that it costs the farmer approximately

6 kyats to produce 1 viss of groundnut. The government price to the Township Cooperative is approximately 10 kyats per viss but the private mills have to pay 20 kyats and up. As the private sector produces approximately 85% of the edible oil, this suggests the reason for the relatively high cost of edible oil to the public. The processing of oilseed contributes approximately 25 pyas to the cost of a viss of edible oil.

I visited Rangoon EOPD for project discussions and also during this time the project car arrived from Rangoon.

Visitors to Mandalay EOPD were:

Mr. Douglas Pickett, ADO, USAID
Mr. Dennis Weller, Project Officer, USAID

JUNE 1987

Dr. Than Htaik paid a visit to Chan Mya Thazi Oil Mill and U Than Aung attended meetings to discuss progress made at the mill and arrange for a seminar for cooperative members from other townships to receive an update on rehabilitation and process methods.

Visited Dana Bala Private Oil Mill again to deliver economic analysis of process demonstration carried out there. No reply or comment was received.

Visited Sagaing Syndicate Oil Mill several times during the month to instruct on production recording and make arrangements to fit electric motor pulleys to China expellers. Returned to fit pulleys.

U.S. Ambassador to Burma, Mr. Bernard Levin visited Chan Mya Thazi Oil Mill and saw expeller machines being examined for wear after finishing the pressing of one township's groundnut crop.

Also instructed on improved method of processing. Production increased from 6000 viss per day to 8000 viss per day. The following day achieved 13000 viss per day.

Visited Hla Aung and Brothers private mill and workshop at 36 Street, Mandalay. Discussed prices for producing modified process worm for Chan Mya Thazi Oil Mill and Sagaing Syndicate Oil Mill. This workshop has hardfacing electrodes salvaged from World War II days. Had power failures almost everyday at oil mill and house.

I visited Rangoon on project business as Deputy Team Leader.

Visitors to Mandalay EOPD were:

Mr. Bernard Levin, U.S. Ambassador to Burma
Dr. Than Htaik, Project Director, Cottage Industries
U Than Aung, Mandalay Division Syndicate Chairman

JULY 1987

Discussed cracking and removing peanut skins with U Sein Hla. This assists the heating processing before expelling of oil.

Visited Sagaing Syndicate Oil Mill. Larger steam headers and condensate recovery system installed as per recommendations. Their interest is encouraging. Fitted modified pressing worms to expellers. Township Syndicate members objected to changing processing method and changed back to old way. The reason for changing was that oil yield is different from last year's crop.

Received four gallons of solvent from Rangoon MOC for laboratory analysis of seed and expeller cake.

Modified pressing worms made at private workshop and supervised fitting to China expellers.

Visited Meiktila Cooperative Oil Mill and Workshop, Naung U, near Pagan, and Taung Tha Township Cooperative oil mills. Examined premises, expellers, ancillary equipment, steam boilers, etc. Made recommendations for repairs and maintenance of all equipment and discussed purpose of EOPD Project with Township committee members. Report of visit was written and submitted.

AUGUST 1987

Visited German neem tree seed project to look at packaged batch solvent plant with capacity of 30 kg per batch which should be suitable for our project. Details sent to EOPD Rangoon.

Major breakdown of one of the Krupp expellers. The main gear transmission has stripped teeth. Can only make repairs with mild steel. It is essential that the correct gear case be obtained abroad or a redesigned transmission if whole machine is to be rehabilitated. Gear parts are being repaired at a private mill which specializes in gear repairs.

Seed grinder being disassembled and overhauled. Screw conveyors being manufactured by oil mill labor for China expeller feed.

Visited EOPD Rangoon on business.

Observed leaking tubes in steam boiler and attempted to expand and seal. These will have to be replaced in December when it is inspected by government inspectors and pressure tested. China expeller cage bars were checked and replaced to 0.040" at feed, resulting in improved drainage of oil.

SEPTEMBER 1987

A small centrifugal blower was installed to the steam boiler fire box to assist in combustion of wet sawdust fuel. This is a constant problem during the rainy season. Storage at the oil mill is covered but not close to the supply source.

Bevelled gears failed on #1 Krupp machine. These are soft steel gears made in Burma which is a constant problem.

Elevators on old expellers system to be fitted with new belt and buckles.

Redesigned pressing worm and collar assembly for the China expellers and oil 33" expeller. Temporary shutdown of oil mill due to removal of 73, 35 and 25 kyat notes from circulation. Mill has no money to pay for machinery costs. All workshops closed.

Seed grinders and screw conveyors installed to test effect of grinding groundnut before heating and expelling. Tests show that air removal of skins is necessary to stop groundnut from fluffing up in feed zone. Better feed of raw seed was achieved now that it can be controlled from ground floor area.

Enquiries made about progress of improvement recommendations for Meiktila and Naung U. Both mills are collecting materials and have placed orders for pressing wormsand other machinery.

A record 8-hour production was achieved this month on the China expellers of 160 x 25 viss bags. That represents 4 times the original production rate.

Raw seed grinder motor failed because of lack of motor overload protection. (Project equipment still to come).

Visited Sagaing Syndicate Oil Mill to check on processing methods. Found quite a bit of education needed yet. U Sein Hla explained the reasons for obtaining maximum heat in the raw seed before expelling. We gave committee members the oil content chart I

designed to illustrate that oil yield was related to the raw seed's growing environment and weather as well as mechanical extraction efficiency. They were also made aware of the varying oil content of raw seed that was revealed by laboratory analysis.

U Sein Hla visited Meiktila Oil Mill and found work had commenced on some of the steam boiler recommendations we had made. A visit to Meiktila Workshop revealed that the transfer of machine tools and equipment to their new premises had not taken place yet.

Visited Rangoon EOPD on business. Commenced R & R leave.

OCTOBER 1987

Returned from R & R leave and attended business meeting in Rangoon.

Chan Mya Thazi Oil Mill had operated satisfactorily for this month.

NOVEMBER 1987

Fitted final modified pressing worms and collars to China expellers which achieved progressive oil extraction and better drainage of oil.

Fitted new bearings to China expeller cooker drives and drive shafts. New bearing also fitted to down feeder flights shaft.

The leaking boiler tubes and wet saw dust fuel are a major problem now. Production and residual oil levels are suffering.

Increased main shaft speed on China expellers to 14 rpm but, although through-put of material increased, residual oil also increased. The expellers were returned to 12 rpm which I now believe is the optimum speed for these machines.

It is becoming apparent that shift supervision is a problem during the late afternoon and night operation and I have discussed this with the oil mill staff. It would appear that it is a problem of pay scale and education, which are not under local control. Incentive of any description is nonexistent.

The feed worm to the China expellers and to the Alpha expeller was changed from a double flight configuration to a single flight design. This produced a bigger discharge of oil at the feed end of the barrel bar cage.

The Chan Mya Thazi Oil Mill was closed down for boiler repairs and renovation.

Traveled to Rangoon EOPD for project discussions.

Visitor to Mandalay EOPD was U Tin Win, Project Manager.

DECEMBER 1987

The Chan Mya Thazi Oil Mill remained shut down for the month to remove and replace 24 number 2.5" diameter boiler tubes which were #5 gauge instead of #12 gauge. This will reduce the heat transfer efficiency. The government warehouse only has 2.5" * #5 gauge. These tubes had been stored touching each other and were badly corroded. A private company did the re-tubing and was very good. The quality of work was excellent. The tubes were removed by hammer and chisel and cut with arc welders. The tube ends were annealed in a coke fire and immersed in calcium oxide fitted and rolled. No education was required.

All expellers were disassembled and examined for wear and other problems and rebuilt parts were installed. All elevator boots and sumps were cleansed out and rotten woodwork replaced. Elevator belts were examined and replaced where necessary. Discharge chutes and elevator drum heads were replaced. The raw seed feed conveyors were fitted with a local hanger bearing. Old wooden feed hoppers were replaced with brick and concrete structures. Broken floor areas were relaid with concrete and steps rebuilt. The boiler fire box was completely rebuilt to prevent air ingress and to improve efficiency. Three overhauled expellers were scraped, cleaned and painted. All internal and external walls of the processing area were painted. All electric motors were disassembled, bearings checked and replaced where necessary and the stator windings re-insulated. All the inground oil storage tanks were removed and cleaned. A very thorough overhaul of the oil mill was carried out.

I designed a steam condensate trap and had it made at a private workshop and was able to get the stainless steel components made by another project in the area. This was installed and proved successful.

Preparation of an alternative alkali solution to sodium hydroxide was made and free fatty acid tests were carried out on production, stored and purchased edible oil samples and then recorded. Sodium hydroxide was requested from Rangoon EOPD.

Gearing and bearing specifications were obtained at Mandalay and Meiktila and sent to Rangoon EOPD.

Preparation of premises for the MOC-promoted seminar was made but the seminars were not held.

Visitor to the Mandalay EOPD was Major Ba Htwe of the Rangoon CID.

JANUARY 1988

Designed oil storage drum washer to be built at Chan Mya Thazi Oil Mill's premises from brick and cement rendering. Also edible oil steam heater to dry and sterilize oil before storage.

Mr. R. Perry and Mr. D. Zaleski visited Mandalay to view rehabilitation at Chan Mya Thazi Oil Mill and Meiktila Township Cooperative Mill, a private workshop and Sein Pan Cooperative Workshop. Consulting metallurgist Dr. P. Wieser visited Mandalay to see Sein Pan workshop methods of casting iron and tempering of steel and processing of edible oilseed.

Project team members participated in the metallurgical seminar at Meiktila Cooperative Workshop led by Dr. P. Wieser. Also present were members of the Sein Pan, Mandalay, Naung Yoe, Yenanyaung, Pagan and Meiktila Cooperative Workshops. The casting of cast iron alloy, carburizing and heat treatment were discussed and demonstrated.

FEBRUARY-MARCH 1988

Several test pressing worms were installed in the China machines. One type was made from gray cast iron. It was not heat-treated or stress relieved. This part failed after four hours of operation. Another pressing worm that was tested was made of "chilled cast iron". It was installed in the most severe wearing location. Examined the test part on March 31 and there was no sign of wear.

Assisted D. Zaleski in the Prome oil mill renovation for the balance of the month.

APRIL 1988

Traveled to Meiktila to visit the oil mill. The boiler renovation was completed. The manager stated that the boiler tests indicated a 30-40% reduction in costs. This is important in that the boiler uses wood which is the only available fuel in this area and the wood

represents a major cost item. We invited the manager to make a presentation to the oil mill seminar at the end of the month.

MAY 1988

Assisted Zaleski in the oil mill at Prome. Travel restricted due to riots.

JUNE 1988

Traveled with the evaluation team through their tour. Met with the team in Rangoon.

JULY-AUGUST 1988

In the absence of R. Perry who was in Germany with the observation tour, I was the designated team leader in Rangoon.

APPENDIX K

Types of Expellers Currently in Use in Burma

1. **KRUPP:** This type of expeller is predominant in Burma. It is typically powered by 15 to 20 horsepower and has an expeller cage that is 41" long. The shaft is stepped and the diameter varies from 7.5" at the feeding section down to 6", then back to 7" at the discharge end. This arrangement is complex and requires many different parts. The expellers in Burma were built between 1939 and 1958. Capacity is 500-800 lbs./hour.

2. **HEB:** Also common in Burma. It is similar to the Krupp press except that the transmissions have different bearings and gears. This company no longer exists. It was located in East Berlin. This machine comes in two different sizes in Burma. Capacity is 200-800 lbs./hour. Most of these expellers were built between 1953 and 1958.

3. **SKODA:** Made in Czechoslovakia, there are two sizes in Burma. The gear cases employ a planetary reduction system using worm gears. The capacity varies depending upon size and horsepower applied.

4. **ALPHA:** This is a copy of a 1939 version of the Rosedowns expeller and is made in India. It has a capacity of 400-600 lbs./hour.

5. **ROSEDOWNS:** Produced in England, there are two types found in Burma. One is a new design built in 1984 with a 44" long, 6" diameter shaft. It is equipped with a 50 horsepower motor and has a capacity of up to 25 MT/day. In a single pass it can produce oilseed cake with 3-5% oil. The other is a small capacity unit similar to the Alpha.

6. **CHINA:** There are two sizes in Burma and the design is copied from the Krupp.

7. **BURMA:** This was designed and built by several workshops prior to 1962.

8. **ANDERSON:** This was made in the U.S. prior to World War II. There are several versions, all similar to each other. This expeller is often called the Number One. It was built in 1910.

APPENDIX L

Expeller Worm Drive Shaft Arrangements

The expeller worm drive shaft holds a number of parts including the pressing worms and the tapered collars placed between the worms on the shaft (see Engineering Drawings).

A worm is a circular segment about 6" to 7" in outside diameter. The worm hub is hollow and slides onto a solid steel drive shaft that is about 3.5" in diameter and about 6' to 7' long. This shaft is the main expeller pressing shaft and it is directly connected to the main expeller transmission which rotates it at about 12 rpm. The worm hubs are positioned on the shaft so as to exert continuous pressure on the seed. Around the hub is flighting, shaped like a conveyor to guide the seeds through the expeller and maintain the pressure required to press the oilseed, thus removing the oil.

The worms are separated by tapered collars. Typically there are 7 worms and 5 collars in the standard expeller shaft arrangement that the EOPD team developed. However, there can be other configurations of worms and collars, each designed to meet particular conditions that can be present when pressing oilseed. It is these parts that wear and need replacement.

Because there were no materials or machines to make steel parts and because there was no hardfacing equipment or hardfacing rod in Burma when the team arrrived, a crash program was begun in early 1987 to determine the most appropriate methods and materials for making the parts. The team proceeded to design the most appropriate shaft arrangments for use with available materials. Designs were made by the team for new individual parts thought to be the most suitable for Burmese use and reproduction. These parts were then configured into several expeller shaft arrangements. These designs and the arrangements were tested and modified at the Chan Mya Thazi Oil Mill in Mandalay. The most successful of these designs and shaft configuraitons were selected for later use in other expellers.

Since there are at least nine different kinds of expellers in the project, several expelller types were modified to accept the new shaft arranqment as a step towards standardizaiton. This shaft was tested on the computer to determine the comparative pressing characteristics. The results indicated that this new shaft would produce maximum oil extraction and meet the designed capacity needs.

APPENDIX M

Edible Oilseed Processing and Distrubtion Follow-On Project
A Proposal

The follow-on project to the Edible Oilseed Processing and Distrubution program will reinforce the technical efforts of the EOPD technical assistance team up to the time of their evacuation in September 1988. The new project will consolidate all resources, both human and material, used under the original project. As such, the project effort becomes one of:

- -- training in the rehabilitation of oil mills and the modernization of workshops;
- -- continuing the rehabilitation and modernization effort for a target group of mills and workshops through the training process;
- -- reinforcing the practices, begun in the original project, of using locally available materials as much as possible to bring about rehabilitation and modernization in a manner appropriate to the Burmese context;
- -- importing for the rehabilitation and modernization program only those materials that are essential to the effort and cannot be supplied locally.

Under this plan, the original project is continued and reinforced. The new project will continue training sessions and the follow-up activities in the mills and workshops.

A number of considerations must be taken into account. One is the advantage of having the main project activities take place in a more geographically restricted area. To this end it is proposed that the project team be moved to Mandalay and that the core set of project activities take place there. The original project mills and workshops are more easily accessible from this location and the bulk of the production and processing of oilseed takes place in this area. In the original project, permission for travel in the field was more easily obtained in Mandalay and one of the most successful working relationships was with the Mandalay Syndicate. Project activities, to be expanded upon below, will consist of:

- -- training activity at the Chan Mya Thazi oil mill and the Sein Pan workshop over a period of two of the three years of the project;
- -- completion, as part of the training program, of the rehabilitation of the eleven remaining oil mills in the

original EOPD project and modernization of a new set of workshops, the number and location to be determined through a pre-project assessment; the process will include installation of the machine tools already ordered and in Burma from the original project;

-- follow-up, over a period of two years, on how the trainees are putting their training to use and receiving support in their home mills and workshops; this will, of course, be more geographically dispersed since any mill or workshop in Burma will be able to send its workers for training at the EOPD centralized facilities; follow-up will run concurrent with training efforts for those mills and workshops participating in the training program;

-- administration of the loan fund set up for mills and workshops for the purpose of borrowing money to purchase commodities necessary to their rehabilitation; this will be administered by the EOPD team at its central location in Mandalay, and will be available for two and a half years of the project.

Another consideration is that project goals should continue in the same vein as for the original EOPD project. The rehabilitation of mills will be completed and more workshops will be modernized. The four workshops in the original project will continue to improve on their technical capacity to address the supply and repair needs of the mills. The Ministry of Cooperatives will be a part of this continuing upgrading activity through participation in the training program. The mechanism for upgrading would, however, switch from EOPD team members working primarily in the mills and workshops to their putting their efforts into training activities at the central training facility's mill and workshop located in the Mandalay region and into working with training session participants on the upgrading of project mills and workshops as part of the training effort.

A new feature would be introduced by the addition of team follow-up visits to mills and workshops that have sent staff for training at the central training site. Furthermore, MOC staff and the training cohorts would be included in some of the follow-up visits by the project staff, both as observers of progress and problems in the participating mills and workshops and as recipients of EOPD team follow-up support, in Rangoon, for new work on behalf of the edible oil industry that MOC trainees are undertaking in the Ministry.

Format of EOPD Project Follow-On

Training Location

The original project found that the Mandalay Syndicate was one of the few that made money. Since it was such a successful enterprise, it was felt that the syndicate would make a good partner in furthering the goals of the follow-on project. In the follow-on, the syndicate would provide, in the first six months of the project, the necessary training facilities at the Chan Mya Thazi mill through the completion of mill rehabilitation and the building of any classroom facilities the project team deemed necessary. The syndicate would provide both labor and materials for these activities.

The Sein Pan workshop was in the process of being built during the original project. As described, in the main report, Sein Pan is a collective of approximately 50 enterprises without any central facility where EOPD project training could take place. The team for the original project did some work in determining the training needs at Sein Pan and in designing an appropriate workshop. The follow-on technical assistance team will determine the appropriateness for the training program of that assessment and design.

For both the mill and the workshop to be used in the follow-on training, an inventory will have to be made of the commodities already in Burma from the original project. Any needed commodities that are missing will have to be imported in time for the start of the follow-on project.

Training Staff and Participants

Training staff will be the three EOPD team members. One mechanic will be needed for the mill and one for the workshop. Both will have experience in training. The team leader can be a professional in any one of a number of fields: technical project management, small business development and management, agricultural economics. The team leader must have a strong technical background and must be familiar with oil mill equipment and oil mill operation. The team leader should also have a background in training, be a good organizer and teacher, and be able to conceptualize and follow through on the training follow-up strategy to be put in place.

Participants in the training sessions can be any staff member of any oil mill and any workshop serving the oil mills. Each session could also have participants from the Cottage Industries Department (CID) and the Cooperative Department (CD) of the Ministry of Cooperatives (MOC). It is crucial that those participants be people

involved in policy and governance for the edible oil industry and that it be made clear to them how their participation in a training session will impact on the industry and contribute to its improvement and successful operation. Participation by MOC staff should come early in the project training sessions.

It is suggested that the first training session be structured as follows:

for mills: 4 trainees from the Mandalay Syndicate
1 trainee from the CID
1 trainee from the CD

for workshops: 4 trainess from Sein Pan
1 trainee from the CID
1 trainee from the CD

Subsequent sessions would include staff from other mills and workshops and would be bigger, perhaps up to 10 participants but no more than 12. Determining the actual mechanism for choosing participants would be the responsibility of the MOC. The MOC would be responsible for the selection process.

Training Schedule and Content

Training sessions should be four weeks long. Appropriate curricula would be determined at the time the project starts but some suggestions are made here. Each session could provide some lectures to include topics such as presentation of the profile of the edible oil industry, explanation of the EOPD project, and general presentations about the operation and maintenance of a typical oil mill and the role of the workshop in that effort. There would be a great deal of hands-on experience at Sein Pan and Chan Mya Thazi, plus the upgrading work at a project target oil mill and workshop. This last portion of the curriculum would last for two of the four training weeks. Only one set of tools and machines would be needed in the two central training facilities. The nature of the workplace is such that there is plenty of opportunity for all students to be working at some task at the same time.

At oil mills, training would entail all aspects of oil mill operation such as set-up, operation and repair/clean-up of machinery, sanitation practices, and preparation of seed for pressing. The importance and use of the oil analysis laboratory would be included in the training program. At the workshop, training participants would learn what they need to know in order to provide

the services needed by the oil mills in the area of parts manufacture and repair.

The proposed training schedule would look like this:

project months 7-12:	one session, total 12
	three sessions, total 60
project months 13-18:	four sessions, total 80
project months 19-24:	three sessions, total 60
project months 25-30:	two sessions, total 40

Calculations are based on ten students/session in both the mill and the workshop, except for the first session where there are only six students/session. This is an approximation and the actual numbers will vary.

Loan Fund

A major problem in the original project was the lack of a loan mechanism available to the mills and workshops for purchasing the materials needed for the upgrading work being promoted by the EOPD project. This interfered with project progress because without materials and tools, rehabilitation could not proceed. Mills and workshops, while they could identify with the positive results offered by project activities, had little incentive to go forward with rehabilitation efforts because of the lack of a mechanism for borrowing funds to finance upgrading.

It is felt that the availability of such a loan fund in this project follow-on can be used as a mechanism to raise consciousness and enthusiasm among owners about the importance of rehabilitation and encourage them to send staff for training. The major achievements of the original EOPD project are there to use to sell the follow-on project: the superiority of machine parts that last and the value of using processing techniques that result in a superior product. When the availability of a loan fund is added to these, it is anticipated that the mill owners will be eager to participate in the training program. If a loan fund facilitates the purchase of materials and the staff can come back to a worksite that can be upgraded, sending them for training in the first place is more attractive. Having a pool of eager participants for training would, in itself, greatly further the goals of the project.

The loan fund could be financed through import of food commodities under PL480. Such commodities would be sold on the local market and the local currency generated would become the loan fund. The particular mechanism for borrowing would be designed by ACDI and

AID/Rangoon. Market interest rates would be charged. Loan repayments would go back into the fund to be drawn upon by other borrowers. The fund would be administered by the EOPD team from its location in Mandalay.

The size of the fund depends on several factors. A sum between $500,000 and $1,000,000 would cover efforts for the eleven mills remaining to be rehabilitated through the repair of expellers and their associated equipment. For the four workshops already upgraded, $2,000,000 in commodities was spent. Funds needed for workshops would depend on the number targeted for the follow-on and the degree of upgrading to be undertaken. It is suggested that the same range of funds be allotted for the workshops. This would bring the total loan fund to between one and two million dollars.

Commodities

Certain commodities would need to be imported for this follow-on project, including:

1. Bearings and gears: The original project devised a short-term solution to the problem of worn bearings and gears found in the great majority of expellers in the project. The long-term solution is to import these parts which have to be made of materials, and by machines, not currently available in Burma. It is estimated that between $300,000 and $400,000 worth of parts will have to be imported from Germany for the expellers in the mills that were in the original project. These parts are needed to rebuild the expeller transmissions.

2. Steel: About 40,000 lbs. of steel are needed yearly to make 40,000 cage bars for the expellers in the fifteen mills in the original project. Imported steel costs about $.70 per pound, including shipping costs, for a total of $28,000 a year. Some of the steel for the cage bars can continue to be provided locally through the reprocessing of scrap from World War II steel truck springs.

3. Project Vehicles: Approximately $60,000 should be budgeted (includes freight costs, insurance, duty) for two Broncos, or their equivalent, and one 6-wheel truck for the use of the EOPD team. At project end these vehicles would be turned over to the MOC.

4. Hand Tools and Bench-Type Machine Centers: These will be used by the team in its training activities.

5. Materials for Setting Up the Training Program: Certain items will be needed to complete the Sein Pan workshop and the Chan Mya Thazi

oil mill so that they can be used for training. Other materials will be needed, at the training site, during the training period. The combined cost of these items and those in number four, above, would be between $120,000 and $150,000.

6. Short-Term Consultants: If six person-months are used, it is anticipated that the costs will be $50,000.

7. Training Materials: The cost of books, supplies, and visual aids would be about $5,000.

8. Other Commodities for Upgrading: These will be needed for the mills and workshops that are targets for the follow-on project. The cost will be dependent on the status of the commodities ordered and received in Burma for the original project and on the configuration of the rehabilitation and modernization program of the follow-on EOPD project. See discussion of loan fund, above.

The follow-on project would import significantly fewer commodities than the original project whose commodity budget amounted to $4.3 million. The follow-on would handle less than half that amount.

Follow-Up Tours by the Technical Team

These tours, which begin in year two of the project, will occupy an increasingly greater part of the team's time as the project continues. Individual team members will travel to the mills and workshops where trainees have returned and are currently working. Some follow-up should be possible during the time a training group is doing its two-week upgrading work at a mill or workshop.

There are two goals for a follow-up tour:

-- To check that the returned trainee is correctly utilizing his training skills and has support from management to use those new skills; this would include not only verbal support, but also material support in the form of tools, equipment, and raw materials, where appropriate; in effect, this would also be a check that upgrading efforts were taking place in the work environment and an opportunity to provide additional reinforcement of material taught during training;

-- To assist mill and workshop management with the setting up and operation of the loan fund mechanism; the team leader will work with management on assessing their loan requirements, and in

processing the paperwork and documentation needed to obtain a loan.

During the original project, the team worked with approximately 15 to 20 people in the targeted workshops. Though many more worked in each workshop, this was the number directly involved with the mills. At the project target mills, the team worked with about 7 to 10 people at each mill. Given these figures, it is obvious that if training is opened up to any mill and any workshop in Burma, the number of potential trainees is quite high. In order to reinforce and consolidate the training that is given to the few who can be accommodated in this program, it is crucial that the follow-up tours be well thought out and executed. In this way, it is hoped that the maximum benefit can accrue as a result of this rather modest training effort. With just the training group size calculated above, a trained core group of 252 is produced. Considerable time and planning will be required to follow up on these people.

During this follow-up period, short-term consultants could be employed in special training capacities. An example would be a seminar on the procedures for grading seed and how to develop an appropriate price payment structure for raw seed.

Project Schedule

Months One-Six

- * completion of rehabilitation of Chan Thazi oil mill
- * completion of building and equipping workshop at Sein Pan
- * set up loan fund
- * market loan fund with mill managers
- • training curriculum and materials development;
- • selection of participants for sessions one through four (months 7-12)

Project Months Seven to Twelve

- • implement upgrading activities at one mill and one workshop_____
- • hold four training sessions in each mill and workshop (total of 72 trainees)
- • implement loan fund
- • select participants for sessions five through eight (months 13-18)

Project Months Thirteen to Eighteen

- implement upgrading activities at one mill and one workshop
- hold four training sessions in each mill and workshop (total 80 trainees)
- continue loan fund
- begin follow-up tours
- select participants for sessions nine through eleven (months 19-24)

Project Months Nineteen to Twenty-Four

- implement upgrading activities at one mill and one workshop
- hold three training sessions in each mill and workshop (total 60 trainees)
- continuation of loan fund
- continuation of follow-up tours
- select participants for the last sessions, numbers twelve and thirteen (months 25-30)

Project Months Twenty-Five to Thirty

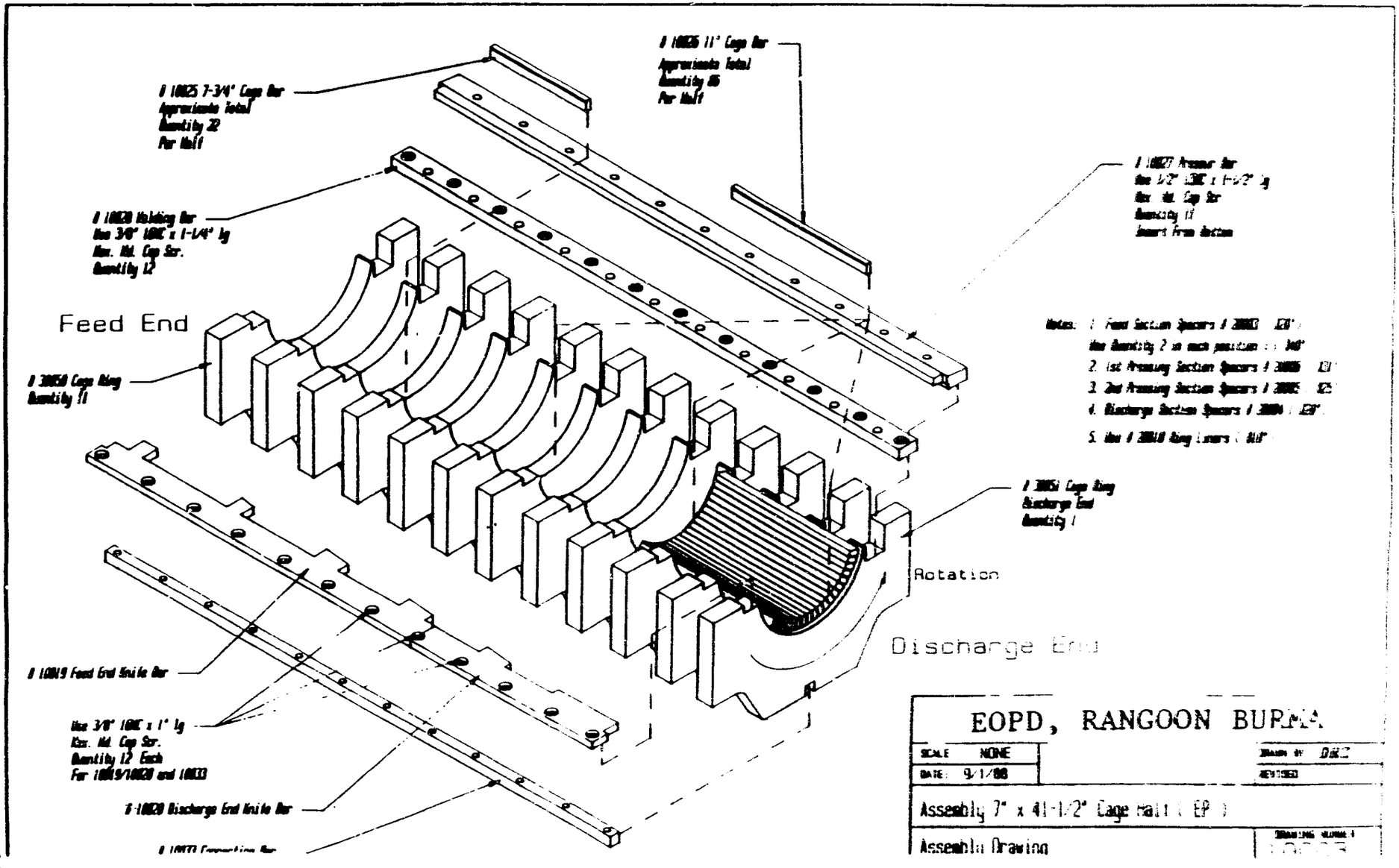
- implement upgrading activities at one mill and one workshop
- conduct last two training sessions in each mill and workshop (total 40 trainees)
- continuation of loan fund; make plans to turn operation of fund over to appropriate SRUB unit
- continuation of follow-up tours

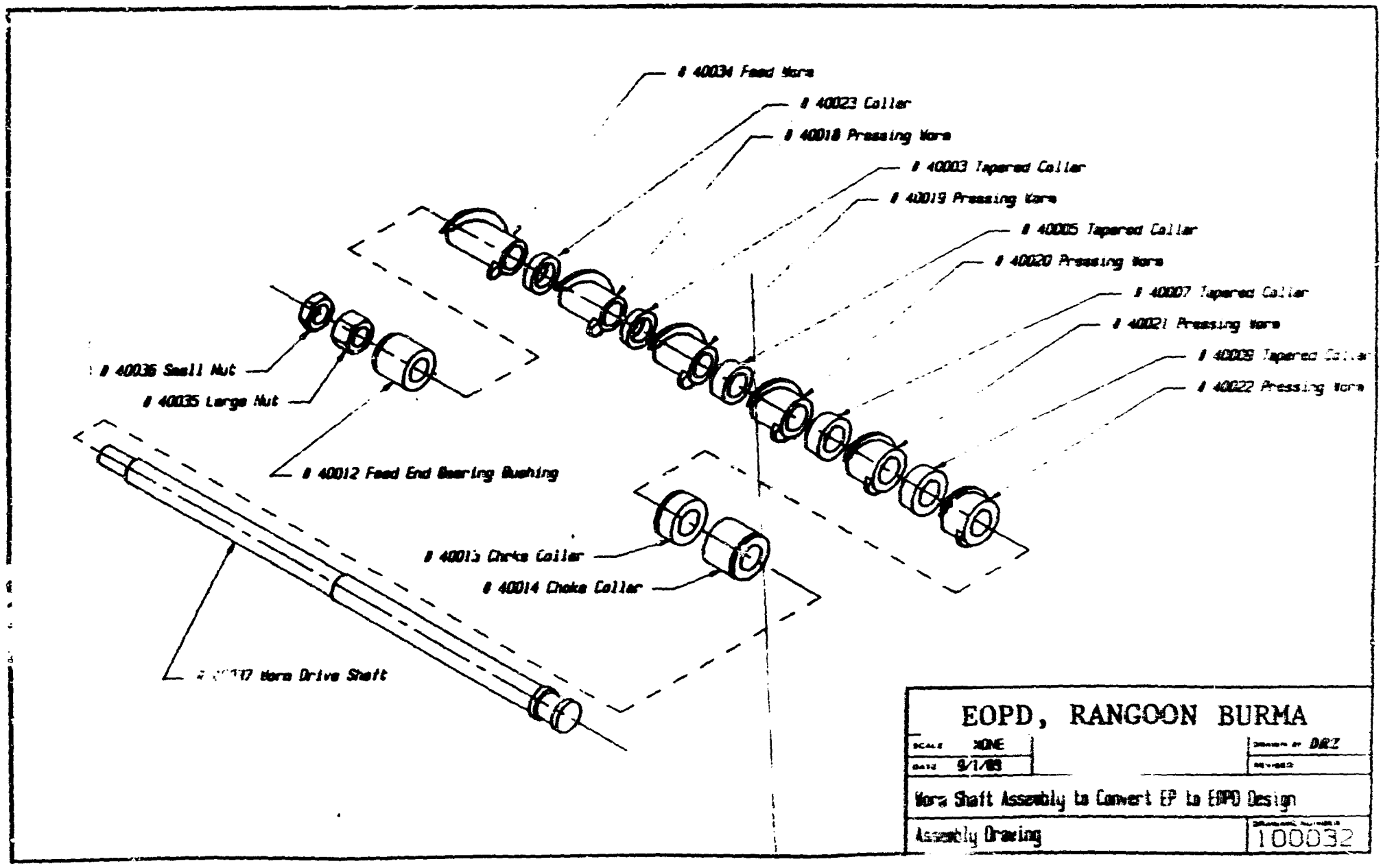
Project Months Thirty-One to Thirty-Six .

- continuation and conclusion of follow-up tours
- turn-over of loan fund to the SRUB
- write project final report

Appendix N

Engineering Drawings


Feed End
Rotation
Discharge End
EOPD, RANGOON BURMA
SCALE NONE
DATE 9/1/98
Assembly 7" x 41-1/2" Cage Mill (EP)
Assembly Drawing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#40023 Collar
#40018 Pressing Worm
#40003 Tapered Collar
#40019 Pressing Worm
#40005 Tapered Collar
#40020 Pressing Worm
#40007 Tapered Collar
#40021 Pressing Worm
#40009 Tapered Collar
#40022 Pressing Worm
#40036 Small Nut
#40035 Large Nut
#40012 Feed End Bearing Bushing
#40013 Choke Collar
#40014 Choke Collar
Worm Drive Shaft
EOPD, RANGOON BURMA
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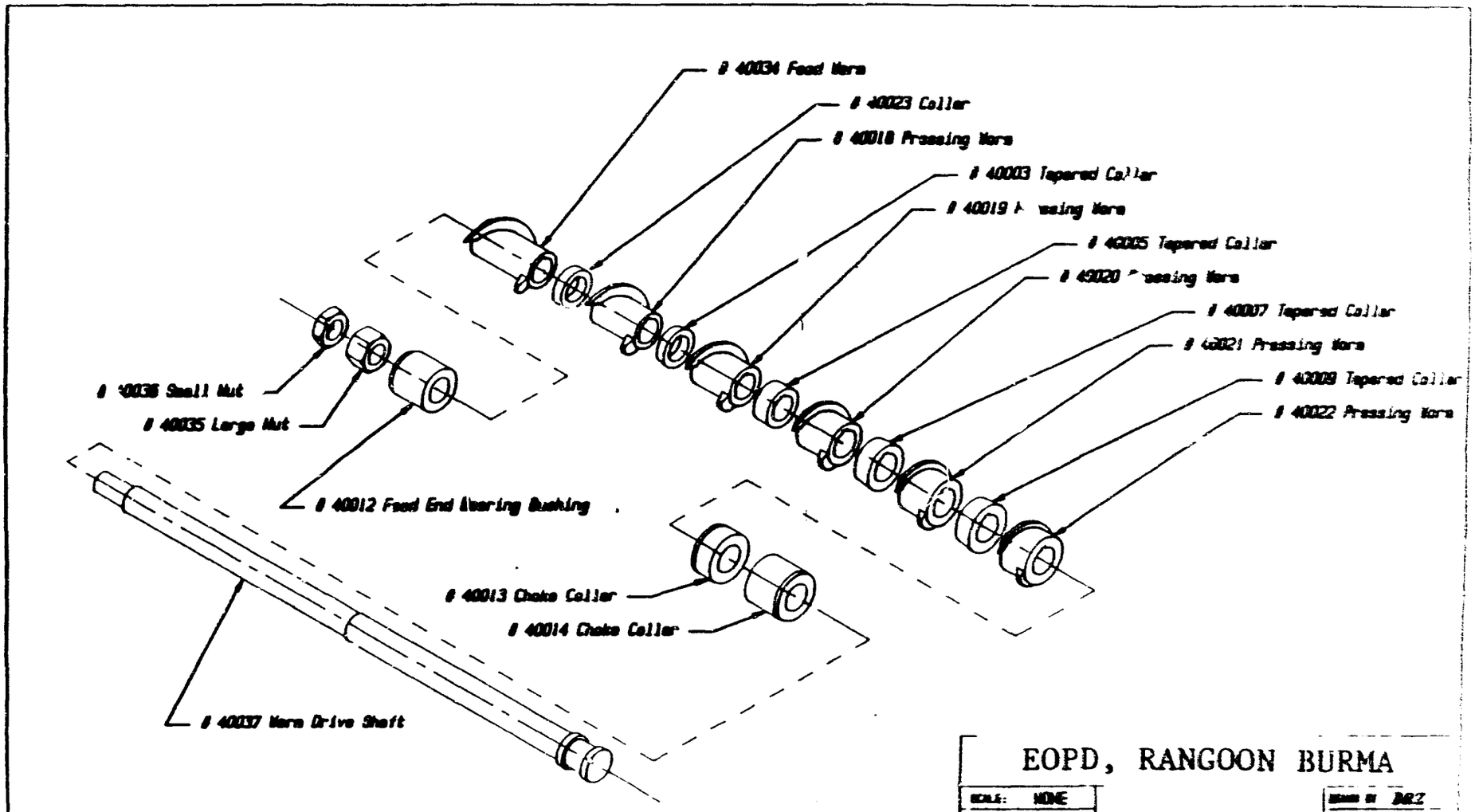
DRAWN BY DRZ
DATE 9/1/88
REVISED
Worm Shaft Assembly to Convert EP to EOPD Design
Assembly Drawing
100032

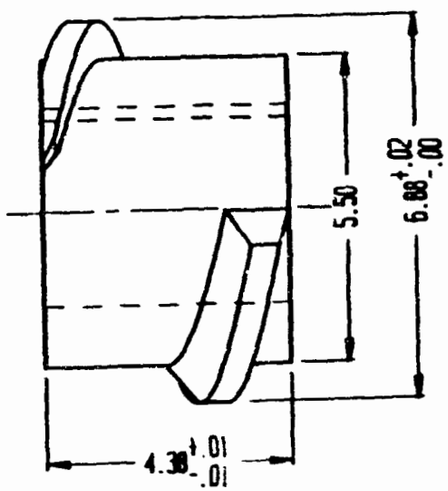


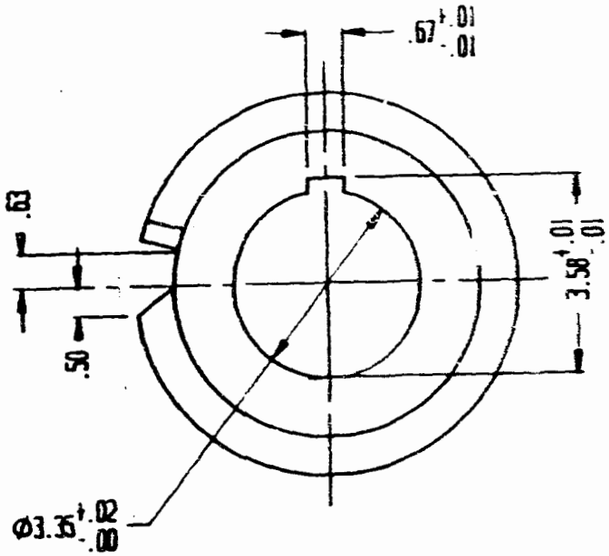
EOPD, RANGOON BURMA

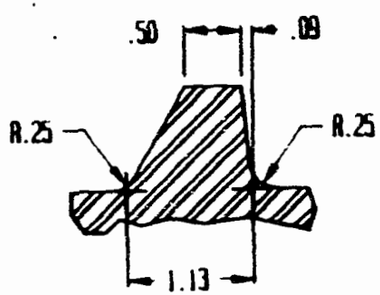
SCALE: NONE	DRAWING # 3822
DATE: 9/1/88	REVISED

Worm Shaft Assembly to Convert EP to EOPD Design

Assembly Drawing	DRAWING NUMBER 100032







Notes: Materiai Cast Iron Alloy
.4 Z Nickle
.2 Z Chrome
Proceedures
1. Machine
2. Quench at 1700F in Brine (10Z)
3. Stress Releive at 600F for 1 Hour

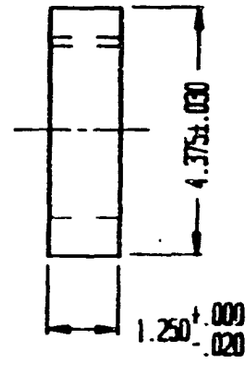
EOPD, RANGOON BURMA

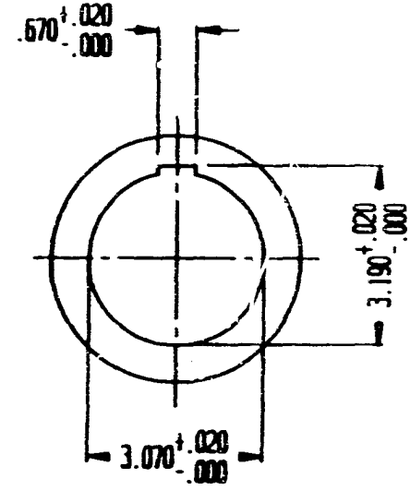
SCALE 6"=1'-0"	DRN DRZ
DATE 9/1/88	NO.

Pressing Worm 4-3/8" Long x 6-7/8" Dia

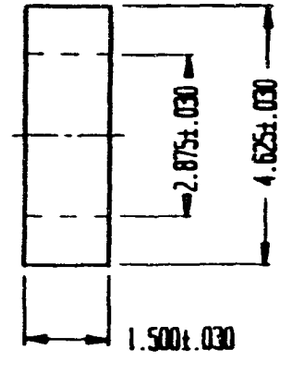
Machining Drawing

40021





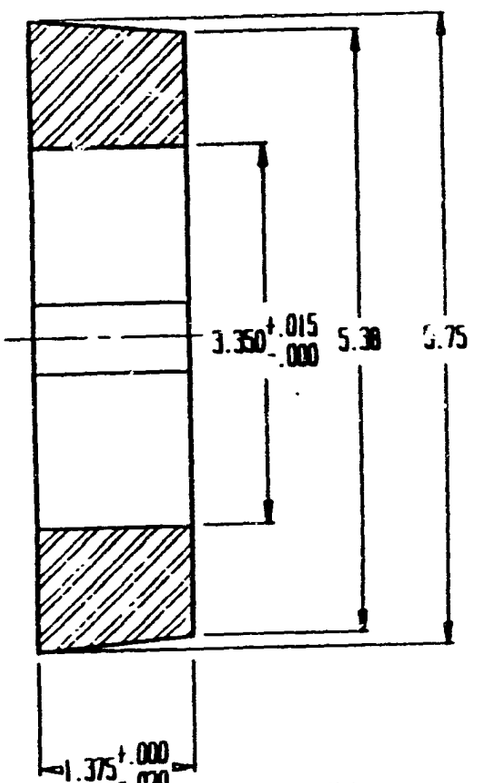
Machining Dimensions



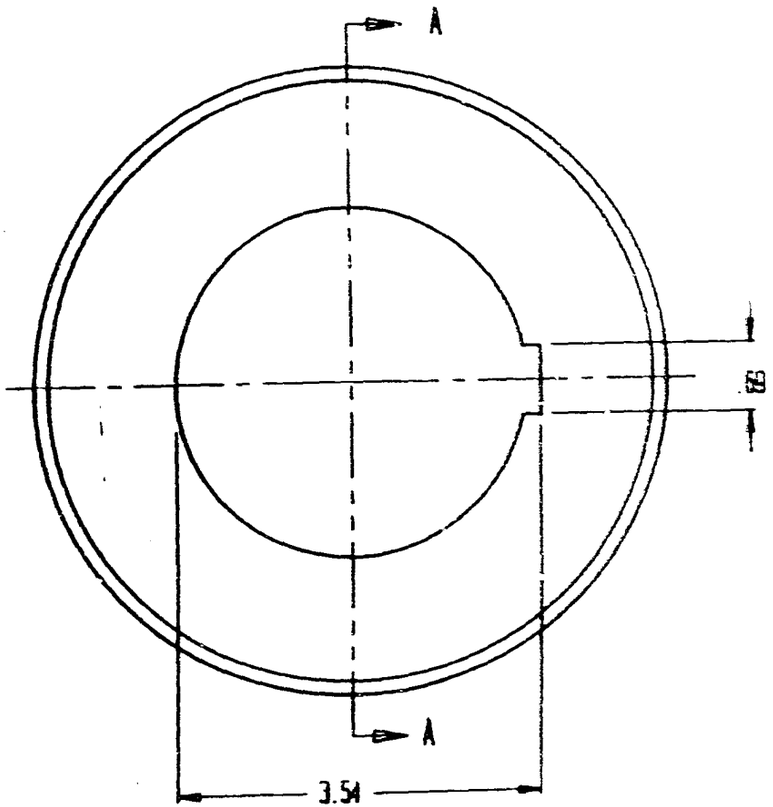
Casting Pattern

EOPD, RANGOON BURMA		
SCALE 3"=1'0"		DRAWN BY DRZ
DATE 9/1/88		
Collar for Prone Update (DAB)		
Casting Pattern & Maching Drawing		DRAWING NUMBER 40036

19



Section A - A



Notes:

1. Material AISI 1045 Heat-treated
2. Heat-treat to 55-62 RC
3. Depth of Penetration .06"
4. Tolerance unless noted .00 = +/- .01

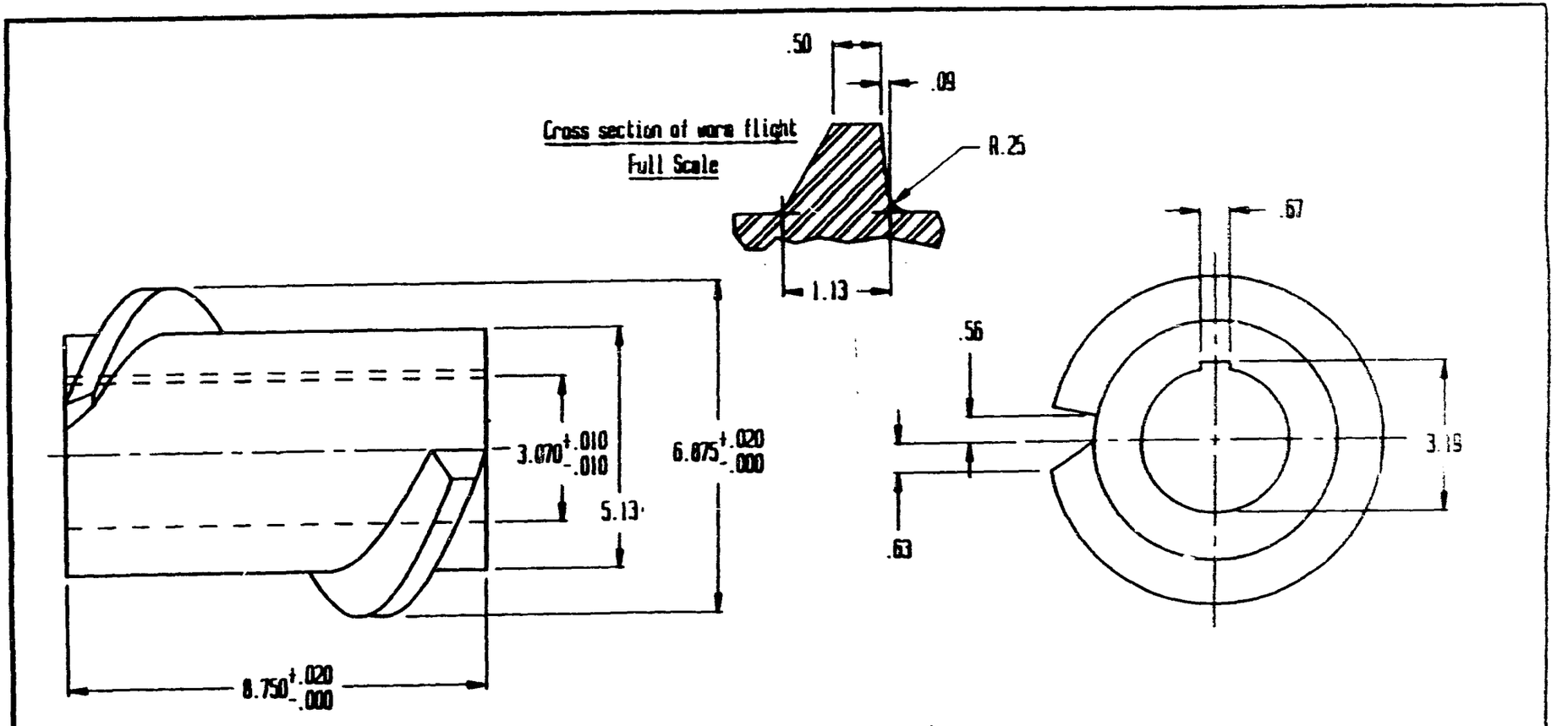
EOPD, RANGOON BURMA

SCALE FULL	DRN DRZ
DATE 9/1/88	APPROVED

Tapered Collar 5-3/8" to 5-3/4" x 1-1/4" Lg

Machine Drawing

40035



Notes:

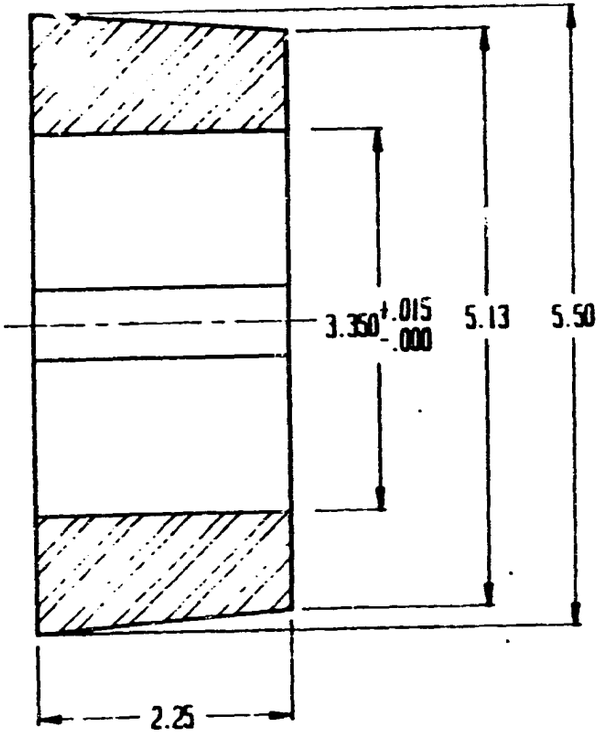
1. Material AISI 1045 Heat-treated
2. Heat-treat to 48-55 RC
3. Depth of Penetration .06
4. Pitch of worm 5.75 "

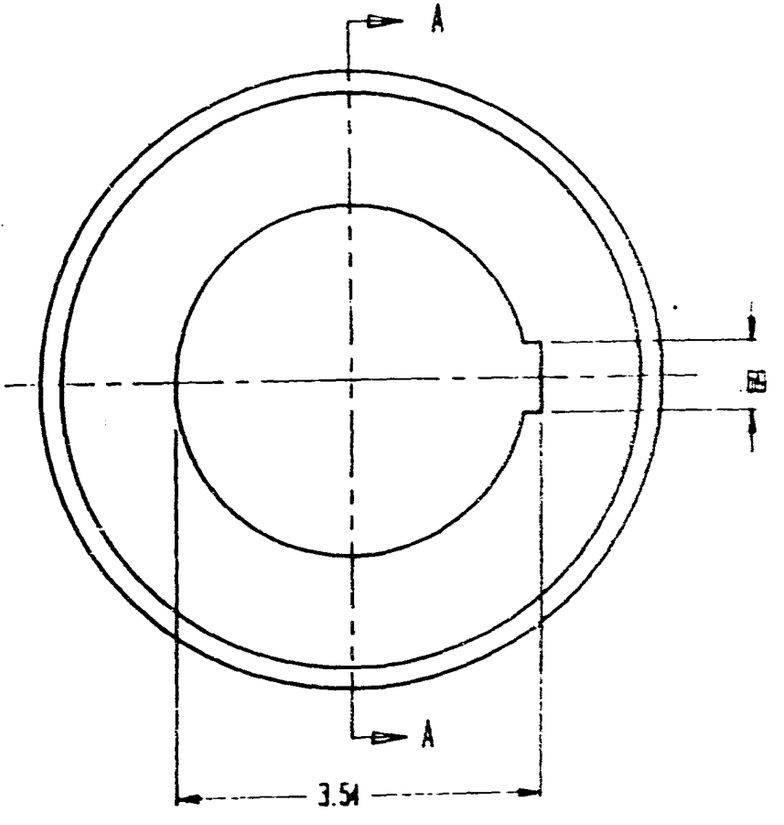
EOPD, RANGOON BURMA

Feed Worm 6-7/8" dia x 8-3/4" lg

Machining Drawing

40033





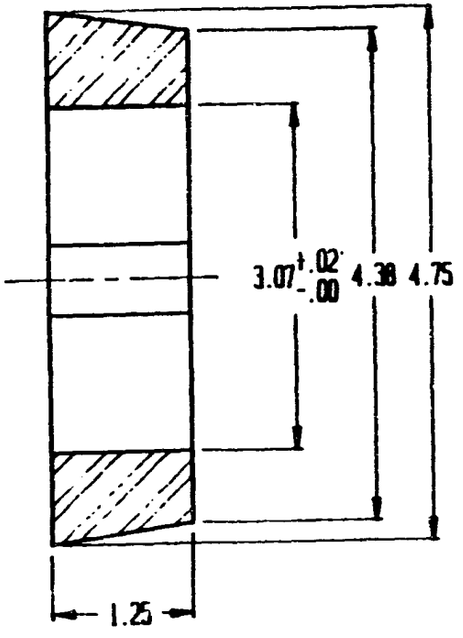
Section A - A

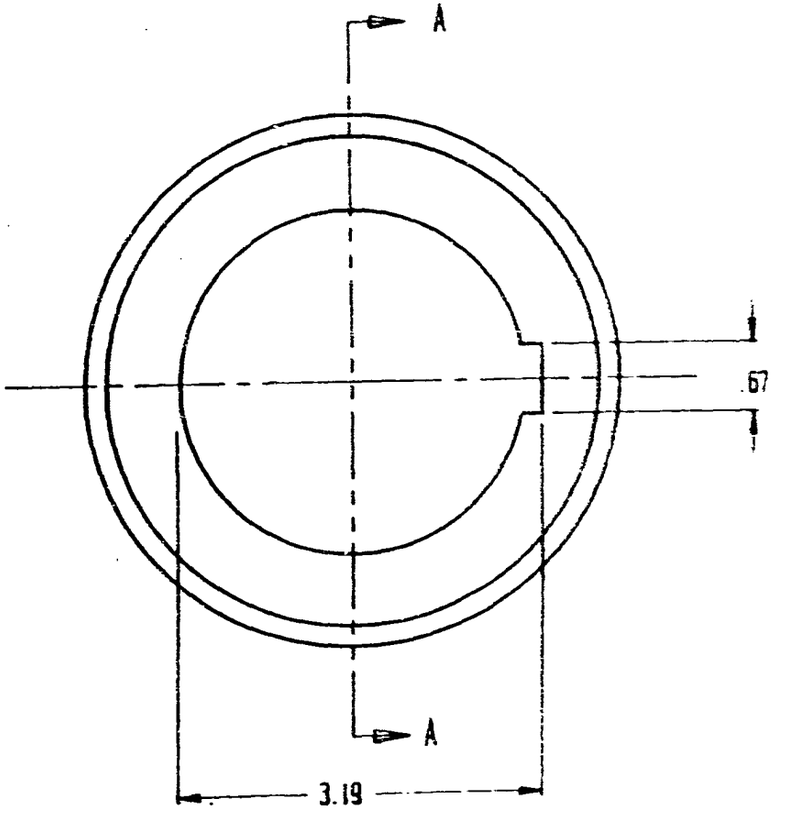
Notes:

1. Material AISI 1045 Heat-treated
2. Quench at 1700F in Brine (10%)
3. Tolerance unless noted .00 = +/- .01"

EOPD, RANGOON BURMA

SCALE FULL	DRAWN DRS
DATE 9/1/88	
Tapered Collar 5-1/8" to 5-1/2" x 2-1/4" lg	
Machining Drawing	40057





Section A - A

Notes:

1. Material AISI 1045 Heat-treated
2. Quench at 1700F in Brine (10Z)
3. Tolerance unless noted .00 = +/- .01"

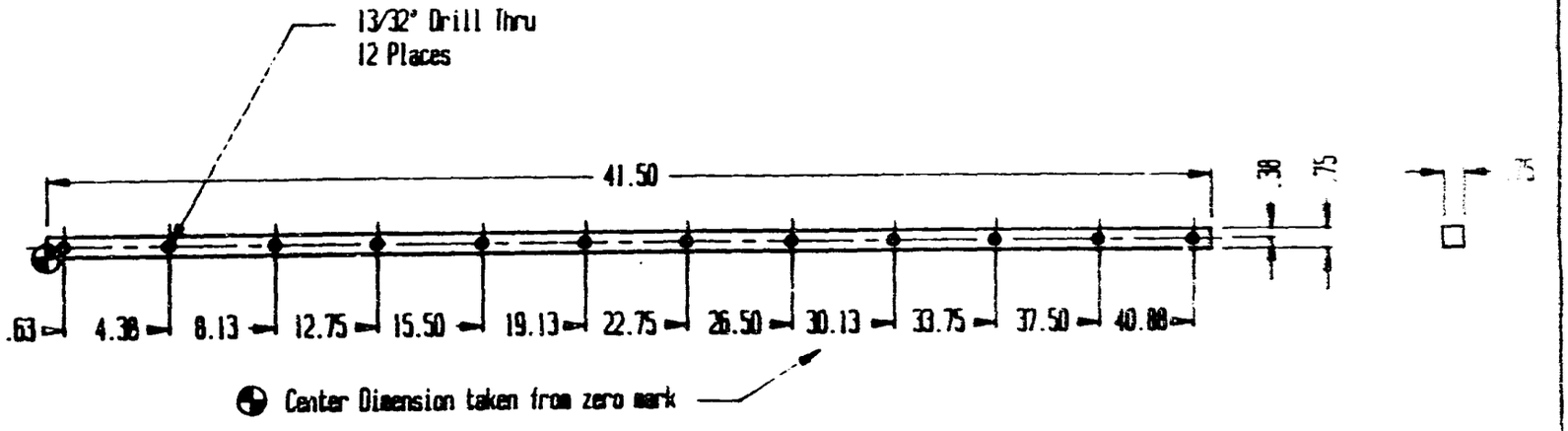
EOPD, RANGOON BURMA

SCALE FULL	DRN
DATE 9/1/88	

Tapered Collar 4-3/8" to 4-3/4" x 1-1/4" lg

Machining Drawing

40003

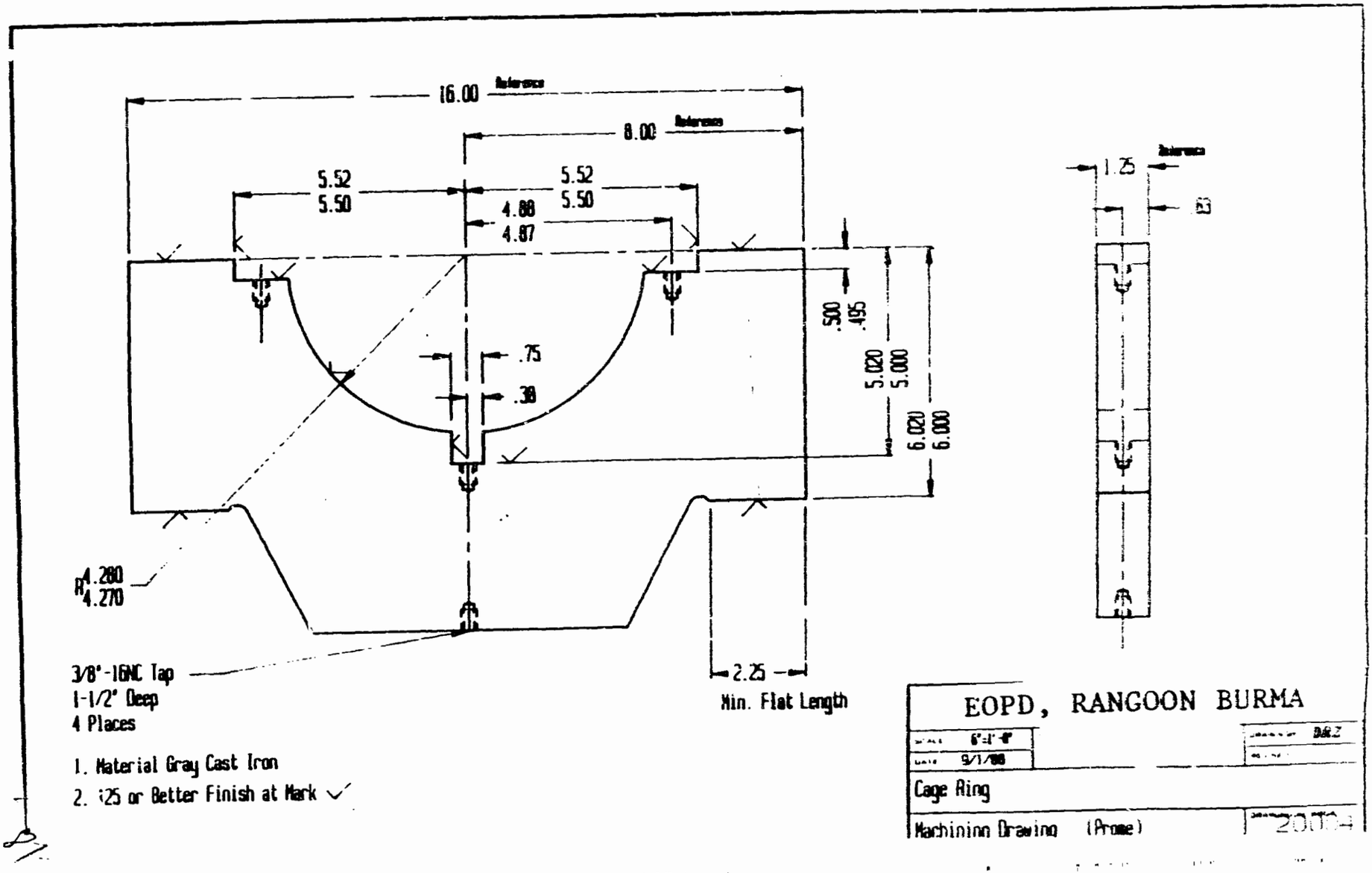


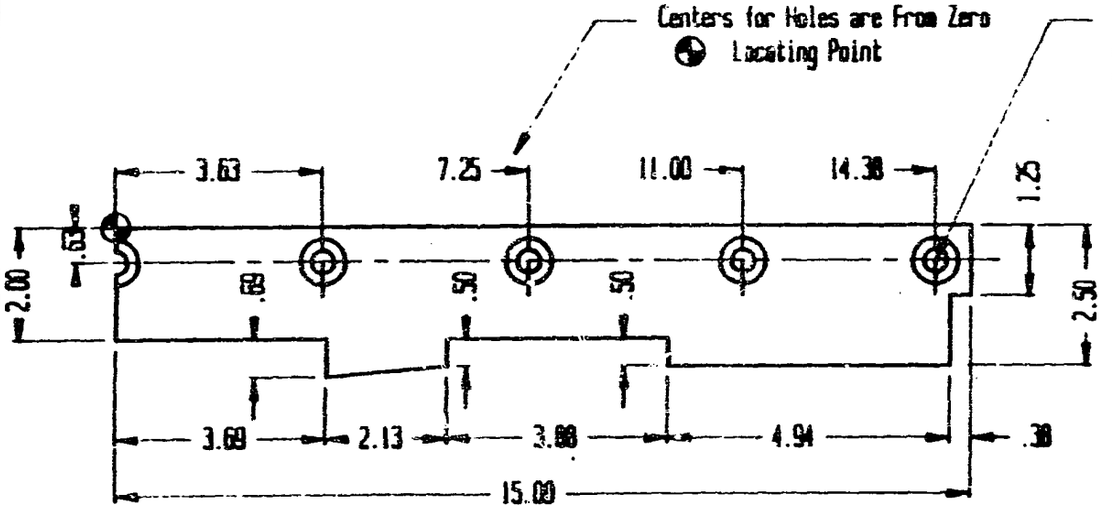
Notes:

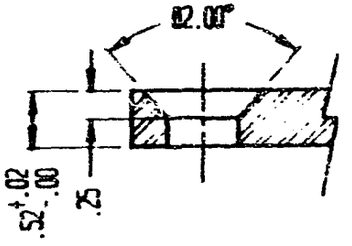
1. Material AISI 1045 Hot Rolled Steel
2. Break All Sharp Edges
3. All Dimensions in Inches
4. Tolerance unless otherwise noted is .00 +/- .010"

EOPD, RANGOON BURMA

Scale: 3=1' 0"	Drawn: DRZ
Date: 9/1/88	
Connecting Bar (Prime049)	
Machining Drawing	20007


16.00
8.00
5.52
5.50
5.52
5.50
4.88
4.87
.500
.495
5.020
5.000
6.020
6.000
.75
.38
R 4.280
4.270
3/8"-16NC Tap
1-1/2" Deep
4 Places
2.25
Min. Flat Length
1.25
.63
1. Material Gray Cast Iron
2. 125 or Better Finish at Mark
EOPD, RANGOON BURMA
Cage Ring
Machining Drawing (Prime)
2004





Counter Sink and Thickness
Detail - Full Scale

Notes:

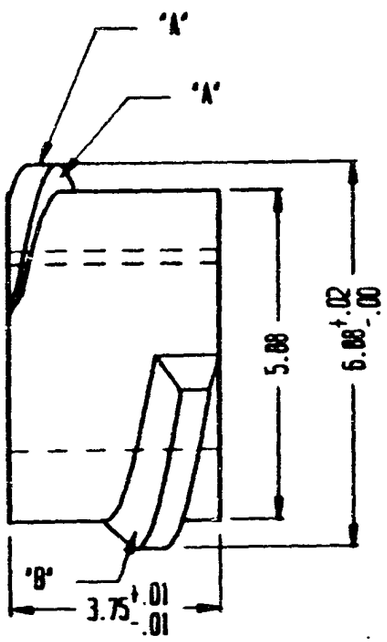
1. Material AISI 1045 Hot Rolled Steel
2. Quench at 1700F in Brine (10%)
3. All Dimensions in Inches
4. Tolerence unless otherwise noted is .00 +/- .010"

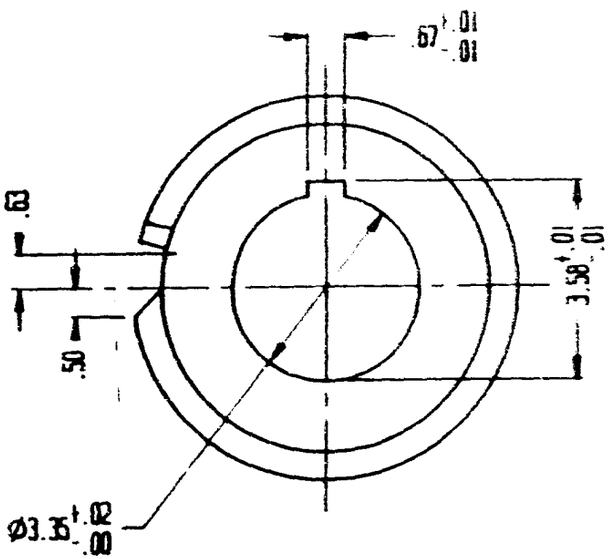
EOPD, RANGOON BURMA

Scale 6"=1'-0"	Drawn by DRC
Date 9/1/00	

Discharge end Knife Bar (Prime0A8)

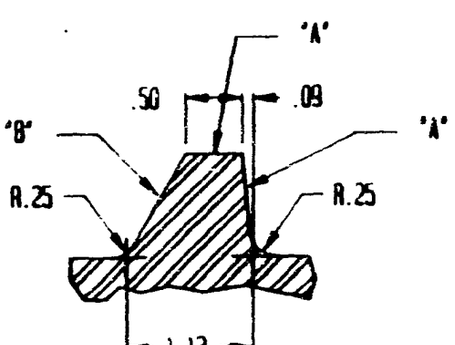
Machining Drawing





Notes:

1. Pitch of Flight 3-3/4"
2. Hub Material, Shaft steel
3. Leading Edge "A" and Flight O.D. to be Special Hard Weld Rod Minimum 1/8" Thick
4. Trailing Edge "B" to be #6 Rod
5. Bore and O.D. Must be Concentric Within +/- .005 and End Faces Must be Square to Bore by .005 T.I.R.

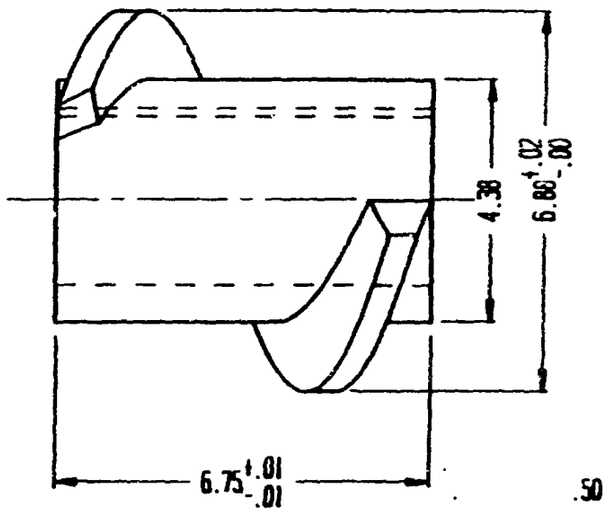


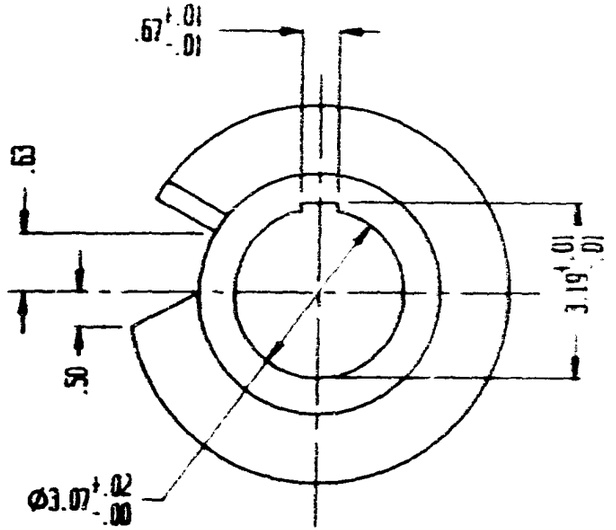
EOPD, RANGOON BURMA

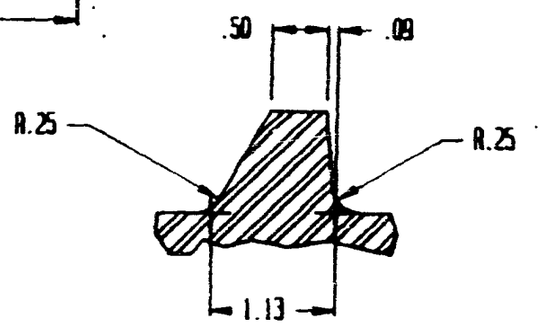
SCALE 6"=1'-0"	DRAWN BY DRZ
DATE 9/1/88	

Pressing Worm 3-3/4" Long X 6-7 8" Dia.

Machining Drawing





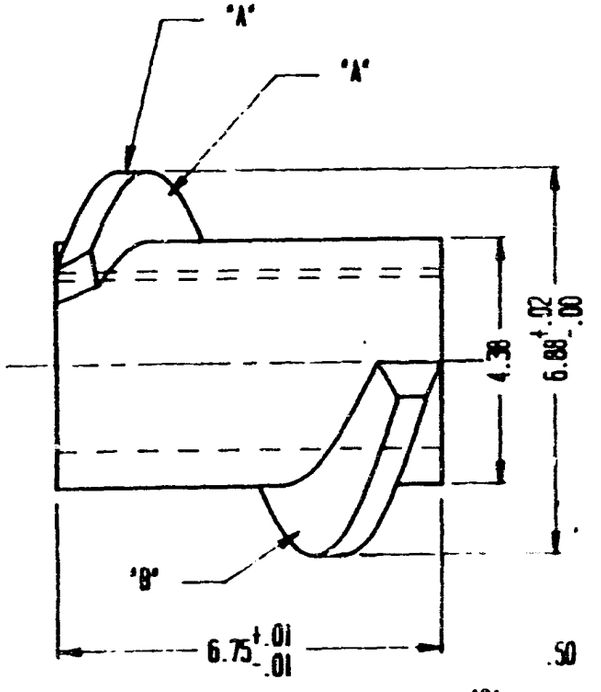


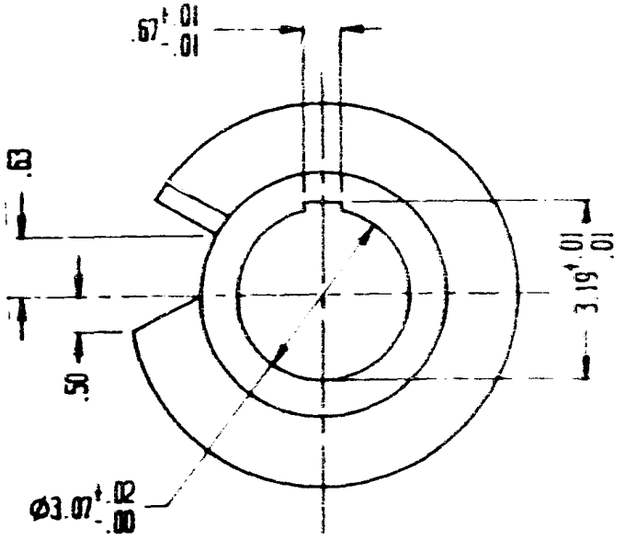
Flight Detail Full Scale

Notes: Material Cast Iron Alloy
.4 % Nickle
.2 % Chrome
Processdures
1. Machine
2. Quench at 1700F in Brine (10%)
3. Stress Releive at 600F for 1 Hour

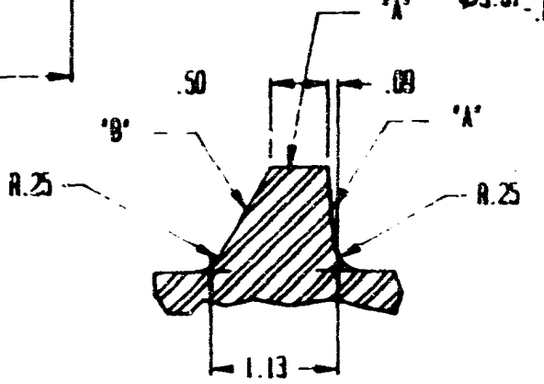
EOPD, RANGOON BURMA	
8"=1'-0"	BRZ
8/1/88	
Pressing Worm 6-3/4" Long X 6-7/8" Dia	
Machining Drawing	40518

90





Notes:
1. Pitch of Flight 6-3/4"
2. Hub Material: Steel
3. Leading Edge "A" and Flight O.D. to be Spaced Hard Build Rod Minimum 1/8" Thick
4. Trailing Edge "B" to be 45 Rad
5. Bore and O.D. Must be Concentric Within +/- .005 and End Faces Must be Square to Bore by .005 T.I.R.



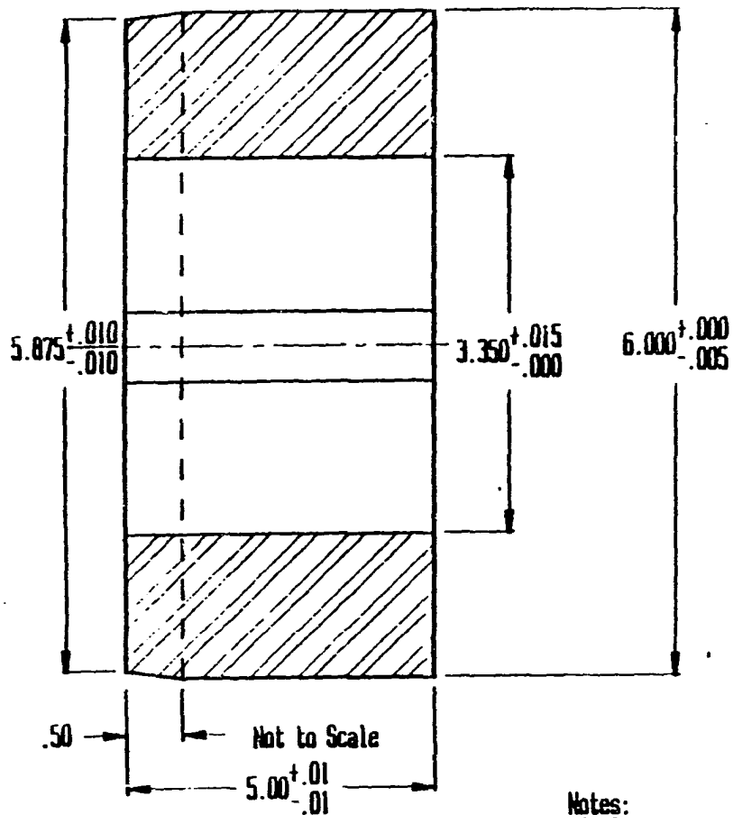
Flight Detail Full Scale

EOPD, RANGOON BURMA

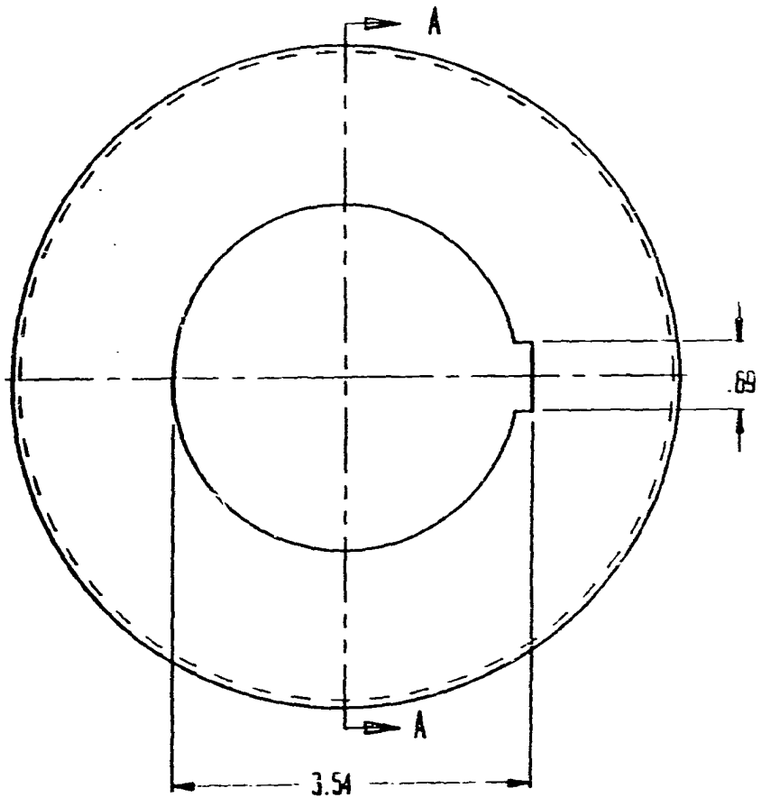
Pressing Worm 6-3/4" Long x 6-7/8" Dia

Machining Drawing

4057-1



Section A - A

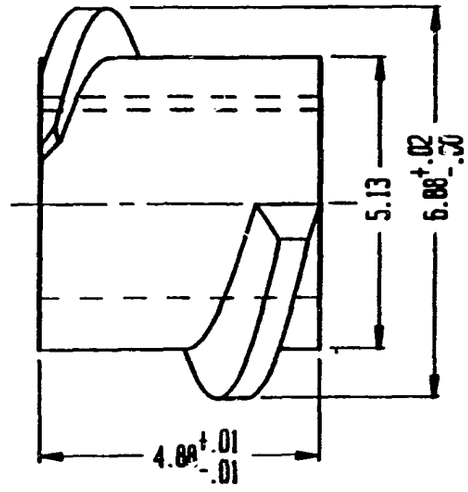


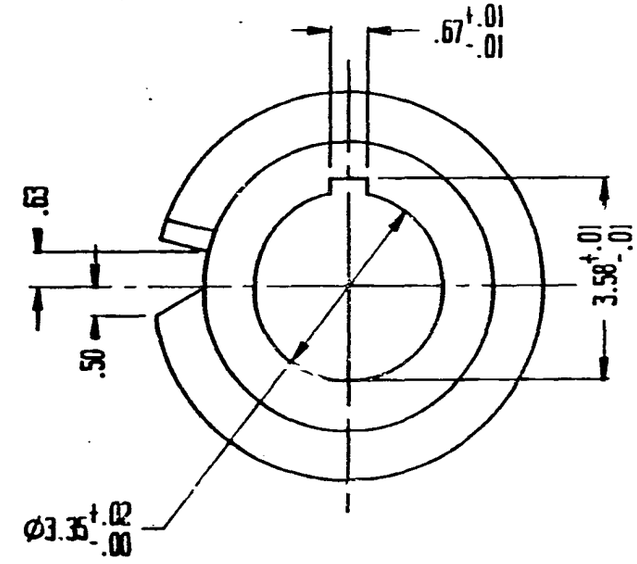
Notes:

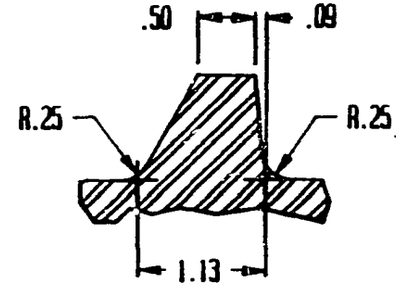
1. Material AISI 1045 Heat-treated
2. Quench at 1700F in Brine (10%)
3. Tolerance unless noted .00 = +/- .01"

EOPD, RANGOON BURMA

SCALE FULL	DRAWN BY DRZ
DATE 9/1/88	REVISED
Choke Collar Long	
Machining Drawing	40014



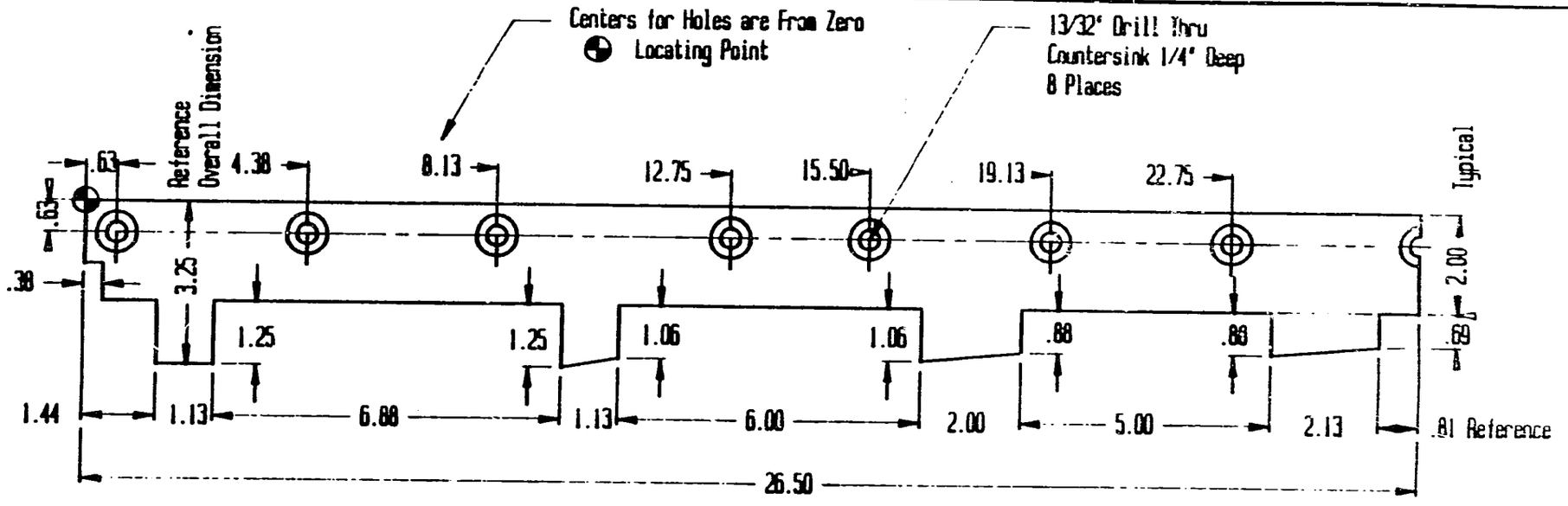




Notes: Material Cast Iron Alloy
.4 % Nickle
.2 % Chrome
Proceedures
1. Machine
2. Quench at 1700F in Brine (10%)
3. Stress Releive at 600F for 1 Hour

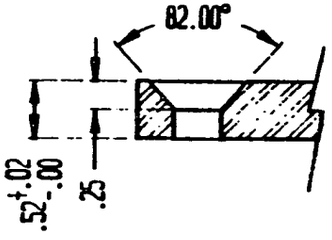
EOPD, RANGOON BURMA	
SCALE 6"=1'-0"	DRAWN BY DRZ
DATE 9/1/88	REVISED
Pressing Worm 4-7/8" Long X 6-7/8" Dia.	
Machining Drawing	DRAWING NUMBER 40020

QB



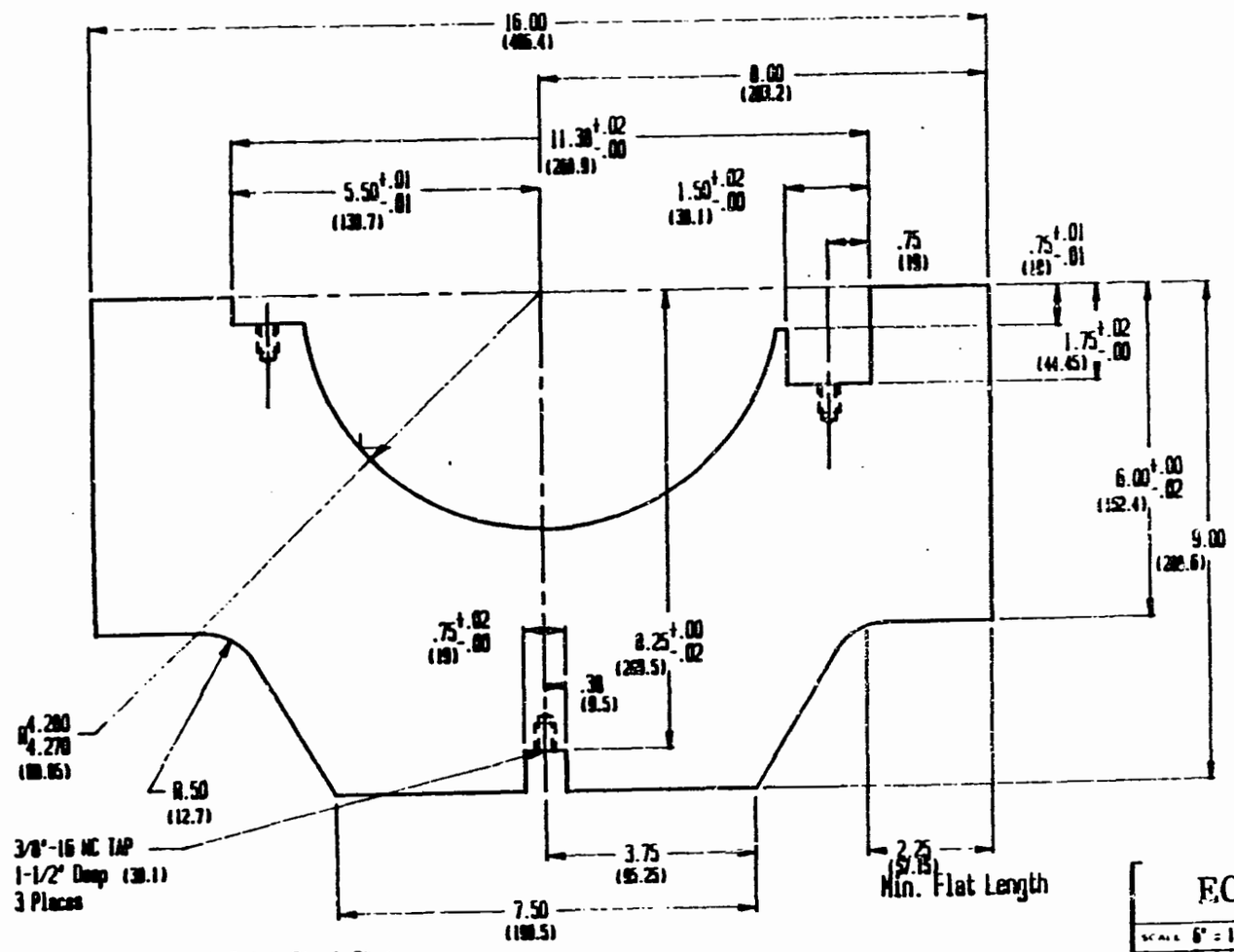
Notes:

1. Material AISI 1045 Hot Rolled Steel
2. Quench Harden at 1700 degF in 10% Brine
3. All Dimensions in Inches



Counter Sink and Thickness
Detail - Full Scale

EOPD, RANGOON BURMA		
SCALE 6"=1'-0"		DRAWN: DRZ
DATE 9/1/88		REVISED
Feed End Knife Bar (Prowl DAB)		
Machining Drawing		DRAWING NUMBER 10019



1. Material, 1-1/4" Thick Steel Plate
2. All Dimensions are in inches
3. (dimension) is in MM

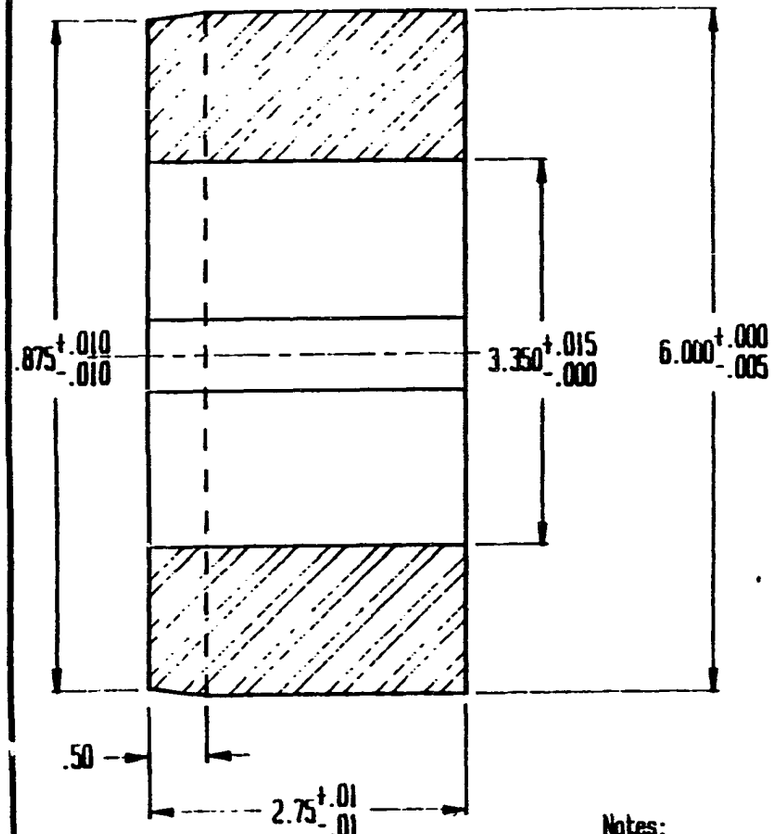
EOPD, RANGOON BURMA

SCALE 6" = 1'-0"	DRAWN BY DRZ
DATE 9/1/88	REVISED

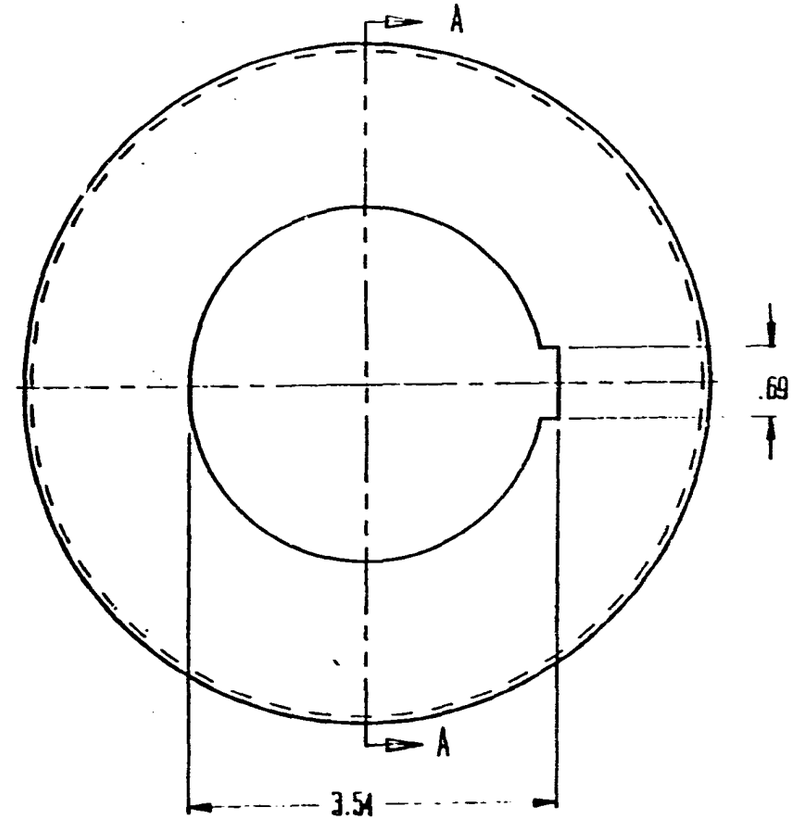
Cage Ring Modification form FP original to EOPD

Machining Drawing

DRAWING NUMBER 20006



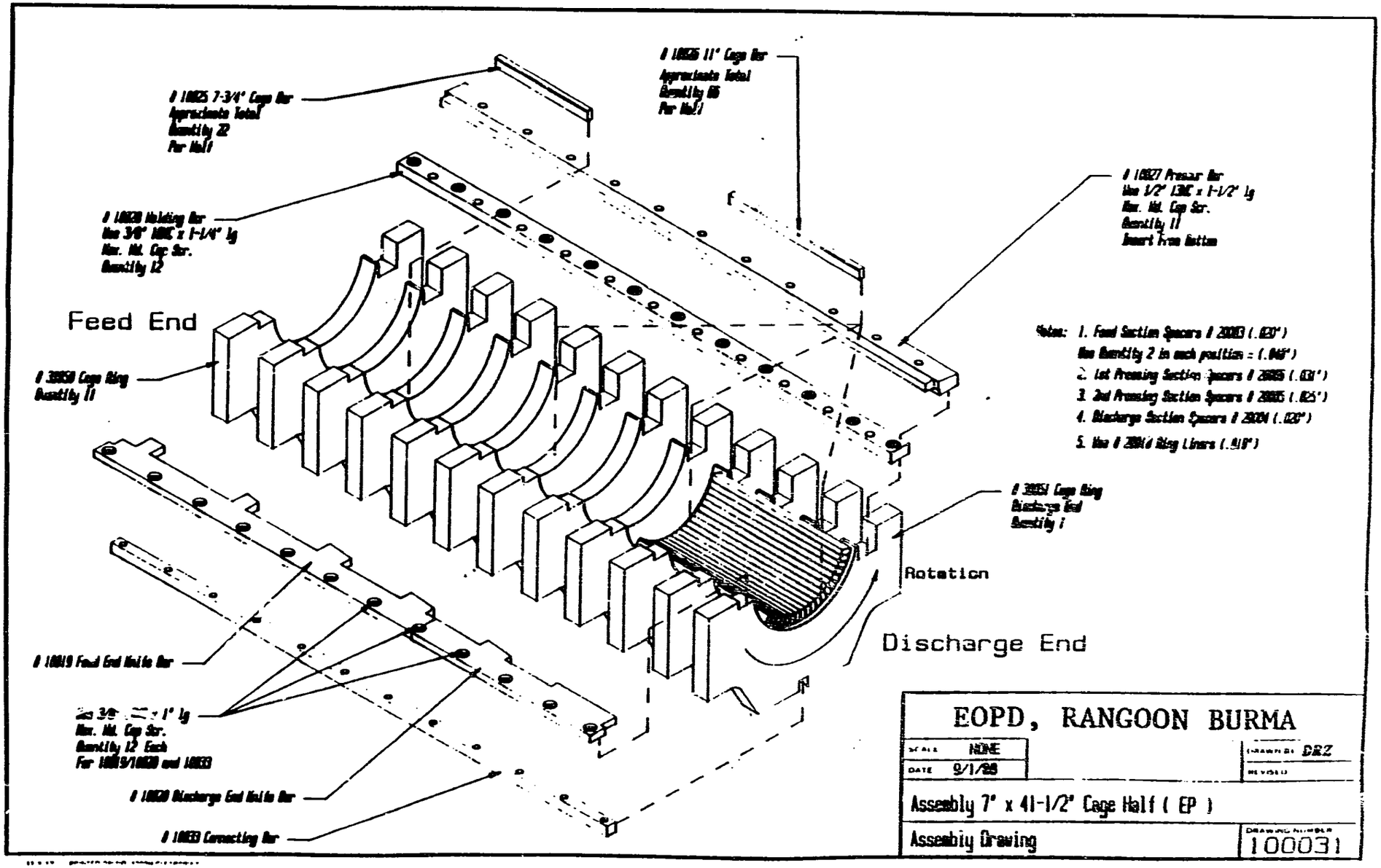
Section A - A



Notes:

1. Material AISI 1045 Heat-treated
2. Quench at 1700F in Brine (10%)
3. Tolerance unless noted .00 = +/- .01"

EOPD, RANGOON BURMA	
SCALE FULL	DRAWN DRZ
DATE 9/1/00	
Choke Collar Short	
Machining Drawing	DRAWING NUMBER 40013



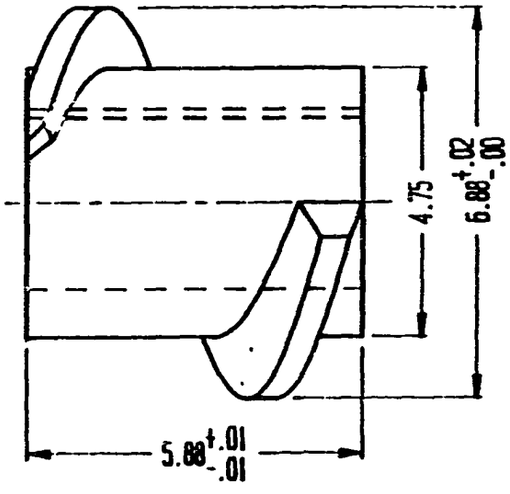
EOPD, RANGOON BURMA

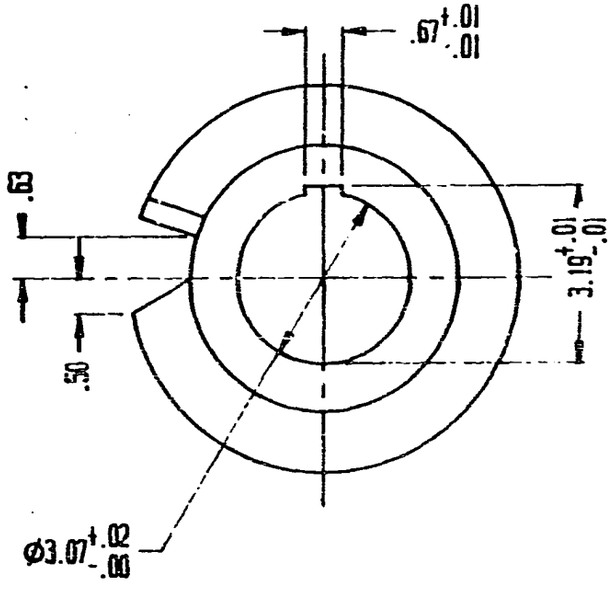
SCALE NONE	DRAWN BY DRZ
DATE 9/1/98	REVISED

Assembly 7" x 41-1/2" Cage Half (EP)

Assembly Drawing

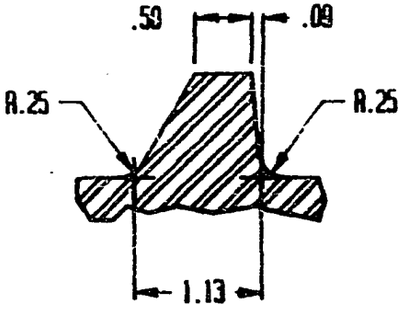
DRAWING NUMBER 100031





Notes:

1. Pitch of Flight 5-7/8"
2. Hub Material, Shaft steel
3. Leading Edge "A" and Flight O.D. to be Special Hard Weld Rod Minimum 1/8" Thick
4. Trailing Edge "B" to be #6 Rod
5. Bore and O.D. Must be Concentic Within +/- .005 and End Faces Must be Square to Bore by .005 T.I.R.



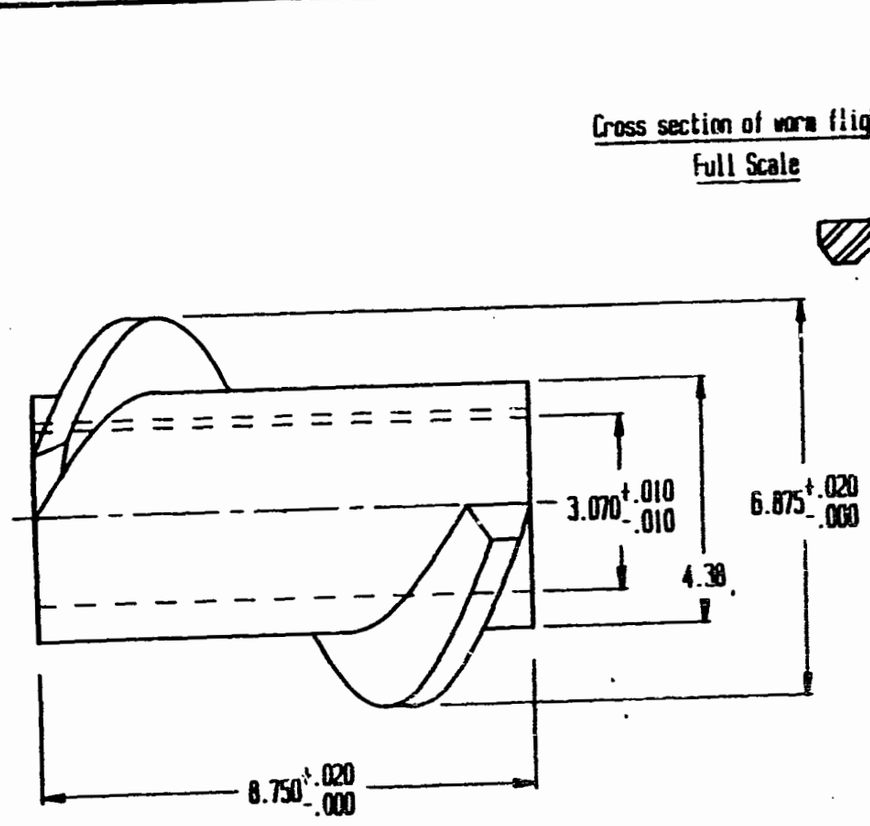
EOPD, RANGOON BURMA

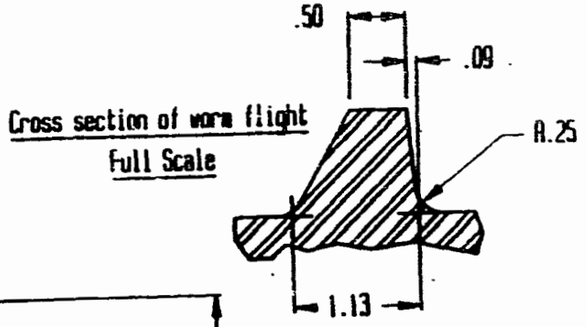
SCALE 6"=1'-0"	DRAWN BY DRZ
DATE 9/1/88	REVISED

Pressing Worm 5-7/8" Long X 6-7/8" Dia.

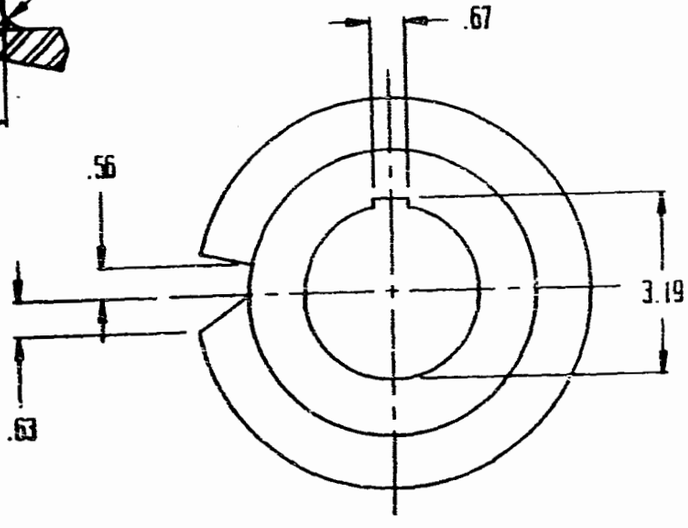
Machining Drawing

DRAWING NUMBER 40012



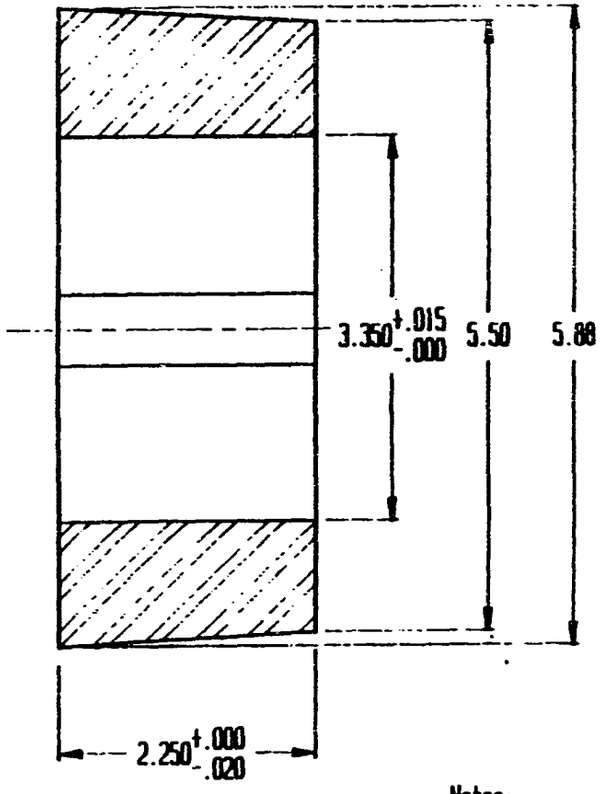


Cross section of worm flight
Full Scale

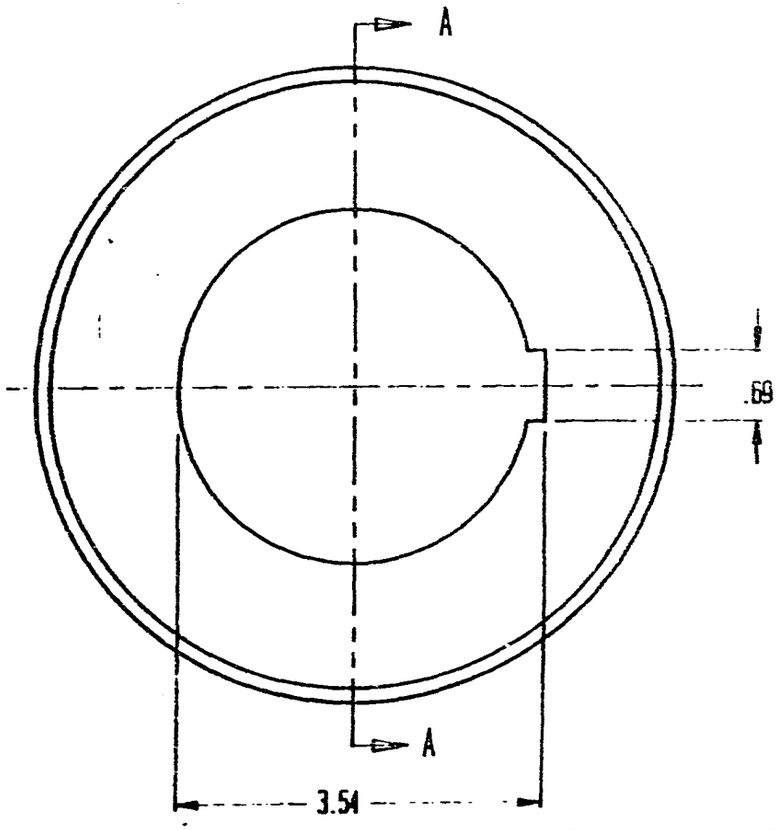


Notes: Material Cast Iron Alloy
.4 % Nickle
.2 % Chrome
Proceedures
1. Machine
2. Quench at 1700F in Brine (10%)
3. Stress Releive at 600F for 1 Hour

EOPD, RANGOON BURMA	
SCALE 6"=1'-0"	DRAWN BY DBJ
DATE 9/1/88	
Feed Worm 6-7/8" dia x 8-3/4" lg (Cast Iron)	
Machining Drawing	DRAWING NUMBER 40034



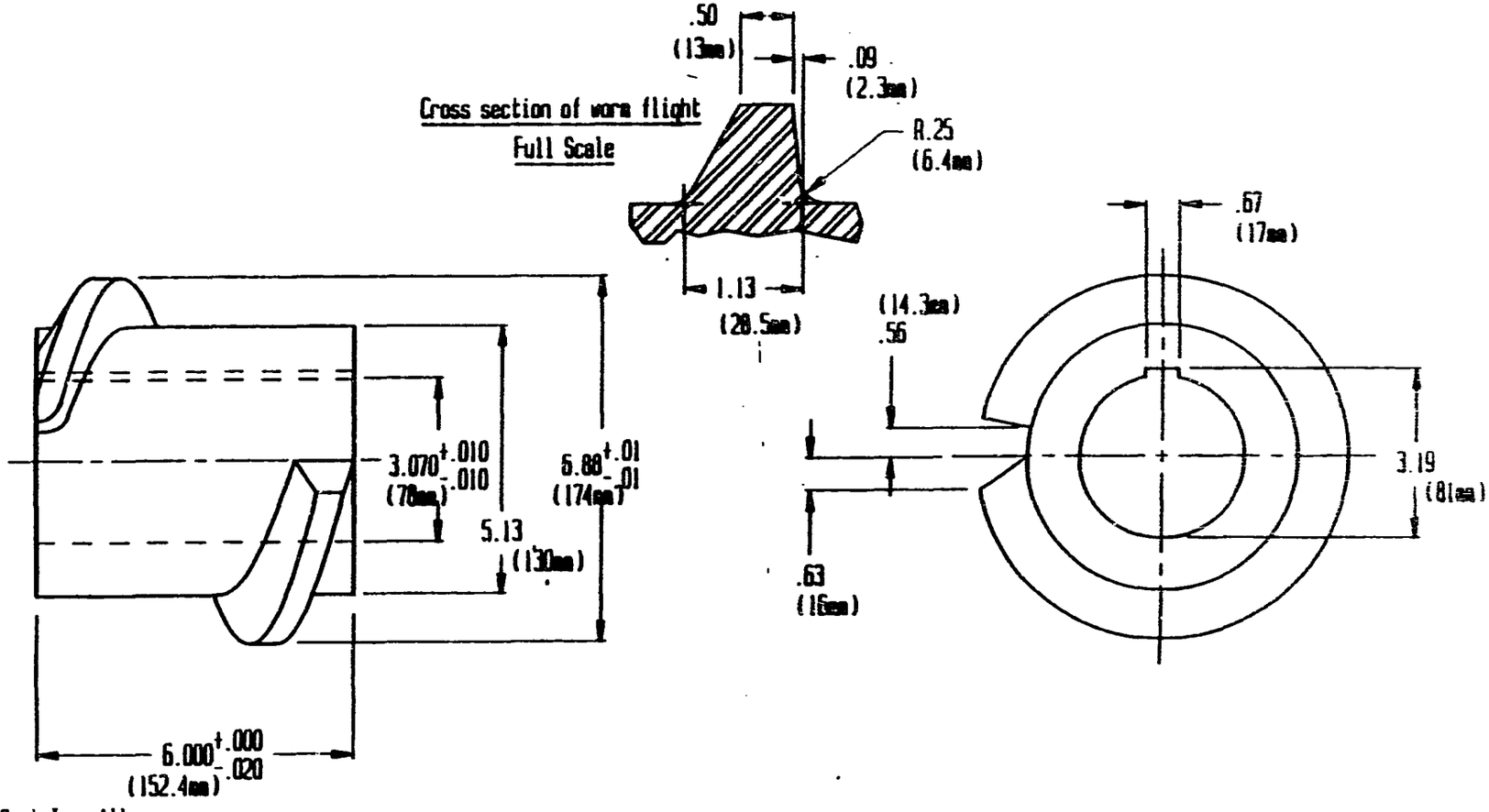
Section A - A



Notes:

1. Material AISI 1045 Heat-treated
2. Quench at 1700F in Brine (10%)
3. Tolerance unless noted .00 = +/- .01"

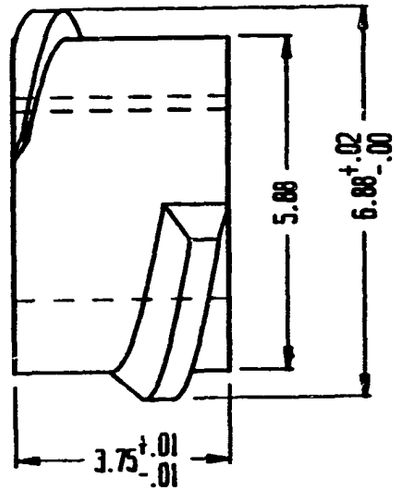
EOPD, RANGOON BURMA	
SCALE FULL	DRAWN BY DRZ
DATE 9/1/88	REVISED
Tapered Collar 5-1/2" to 5-7/8" x 2-1/4" lg x 85mm bore	
Machining Drawing	DRAWING NUMBER 40009

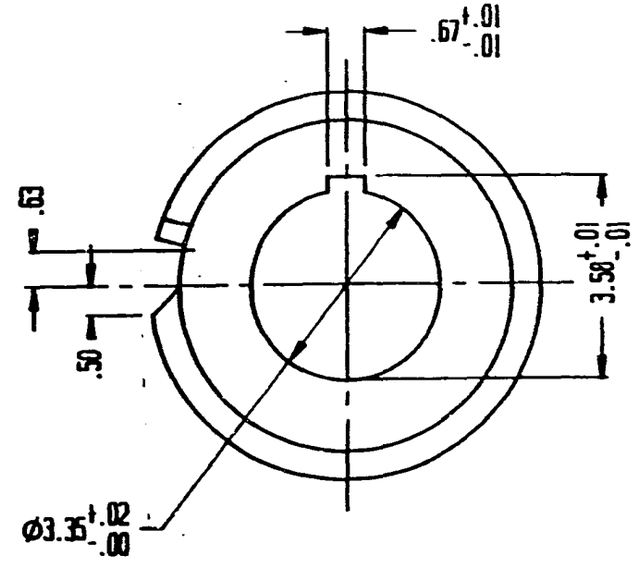


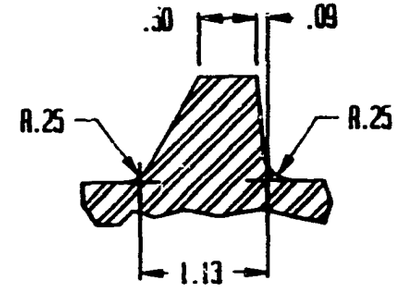
Notes: Material Cast Iron Alloy
.4 % Nickle
.2 % Chrome
Proceedures
1. Machine
2. Quench at 1700F in Brine (10%)
3. Stress Releive at 600F for 1 Hour

EOPD, RANGOON BURMA

SCALE 6"=1'-0"	DRAWN BY GBJ
DATE 9/1/88	REVISED
#1 Pressing Worm (EP) 7" OD x 6" lg (Cast Iron)	
Machining Drawing	DRAWING NUMBER 40032

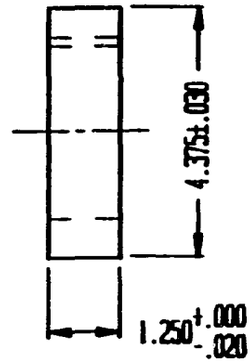


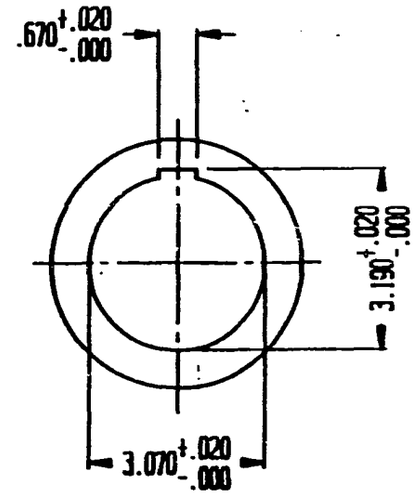




Notes: Material Cast Iron Alloy
.4 % Nickle
.2 % Chrome
Procedures
1. Machine
2. Quench at 1700F in Brine (10%)
3. Stress Releive at 600F for 1 Hour

EOPD, RANGOON BURMA	
SCALE 6"=1'-0"	DRAWN BY DRZ
DATE 9/1/88	REVISED
Pressing Worm 3-3/4" Long X 6-7/8" Dia.	
Machining Drawing	DRAWING NUMBER 40022

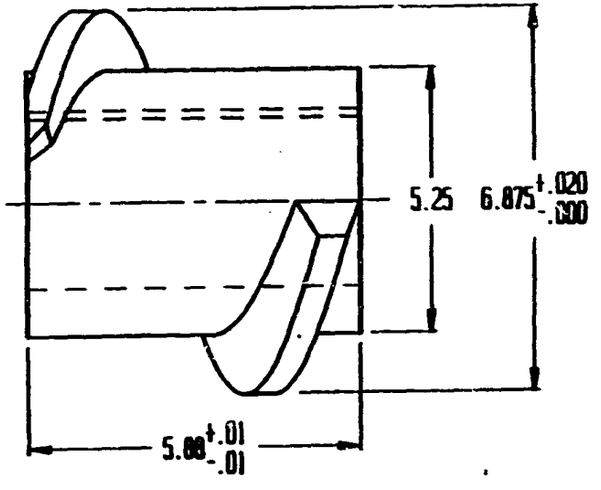


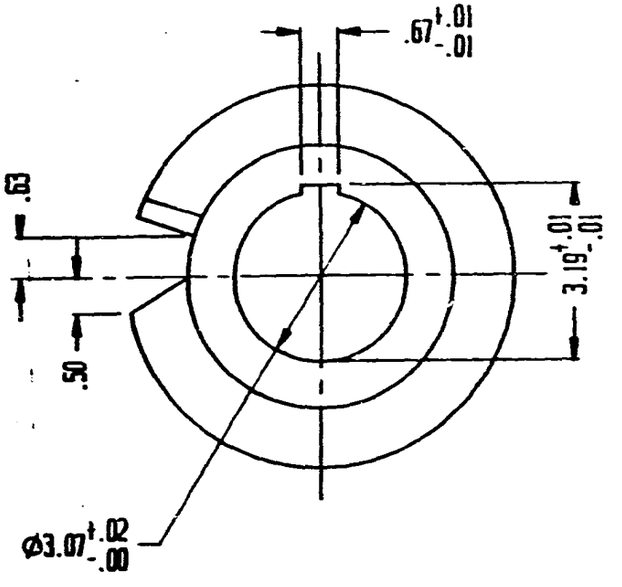


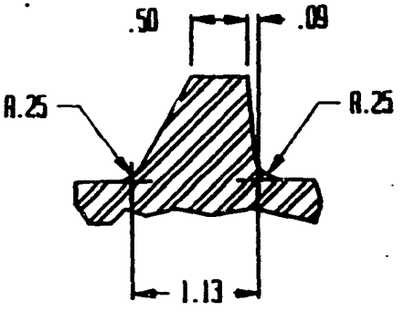
Notes:

1. Material AISI 1045 Heat-treated
2. Heat-treat to 55-62 RC
3. Depth of Penetration .06"
4. Tolerance unless noted .00 = +/- .01

EOPD, RANGOON BURMA	
SCALE 3"=1'0"	DRAWN BY: DRZ
DATE 9/1/88	REVISED:
Collar 4-3/8" dia x 1-1/4" lg	
Machining Drawing	DRAWING NUMBER 40023

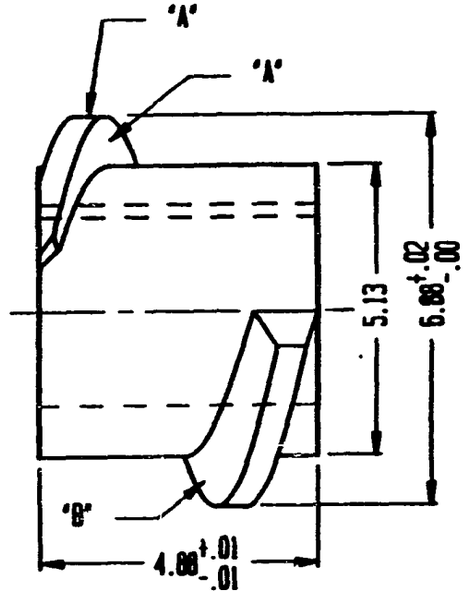


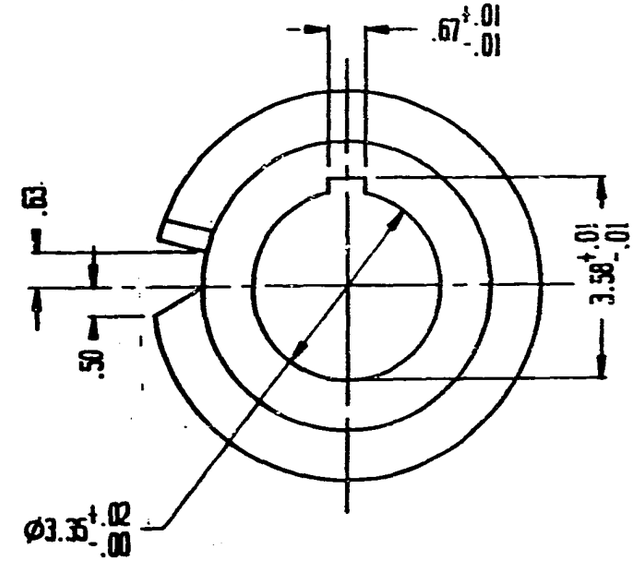




Notes: Material Cast Iron Alloy
.4 % Nickle
.2 % Chrome
Proceedures
1. Machine
2. Quench at 1700F in Brine (10%)
3. Stress Releive at 600F for 1 Hour

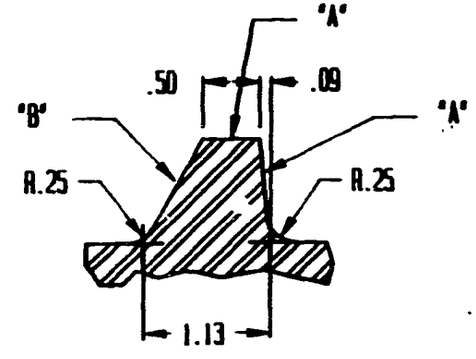
EOPD, RANGOON BURMA	
SCALE 6"=1'-0"	DRAWN BY BRZ
DATE 9/1/88	REVISED
Pressing Worm 5-7/8" Long X 6-7/8" Dia.	
Machining Drawing Prime Update	DRAWING NUMBER 40025



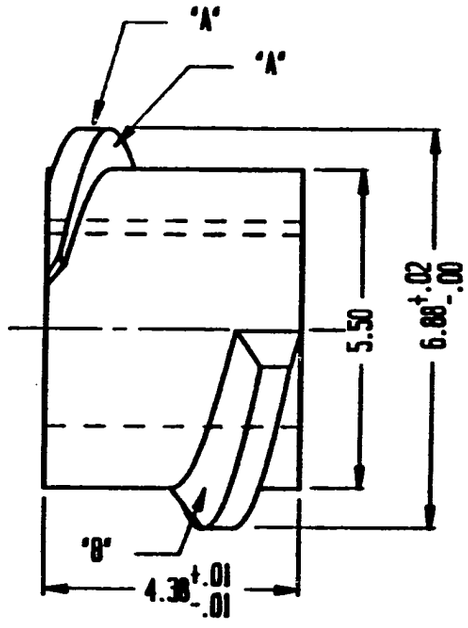


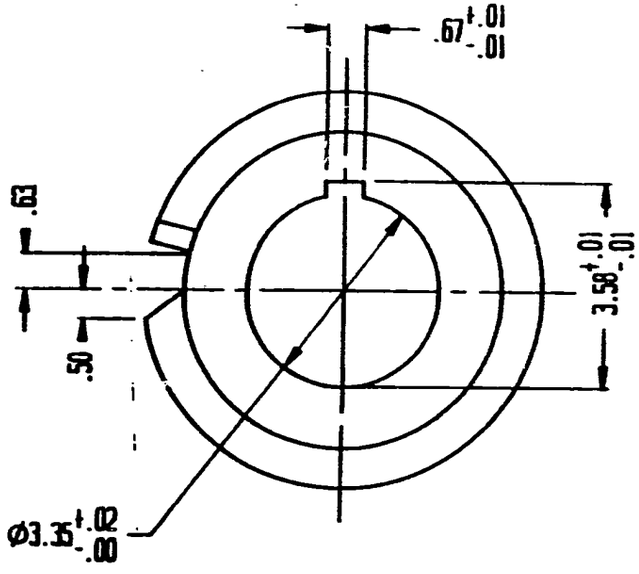
Notes:

1. Pitch of Flight 4-7/8"
2. Hub Material, Shaft steel
3. Leading Edge "A" and Flight O.D. to be Special Hard Weld Rod Minimum 1/8" Thick
4. Trailing Edge "B" to be #6 Rod
5. Bore and O.D. Must be Concentric Within +/- .005 and End Faces Must be Square to Bore by .005 T.I.R.



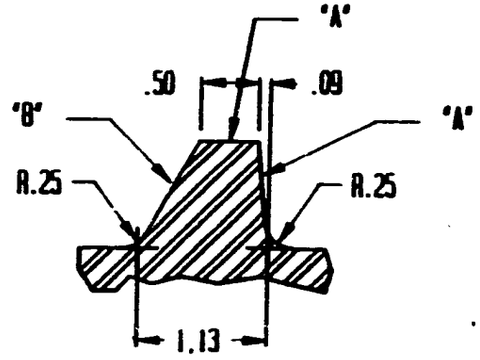
EOPD, RANGOON BURMA	
SCALE 6"=1'-0"	DRAWN BY BRZ
DATE 9/1/88	REVISED
Pressing Worm 4-7/8" Long X 6-7/8" Dia.	
Machining Drawing	DRAWING NUMBER 40113



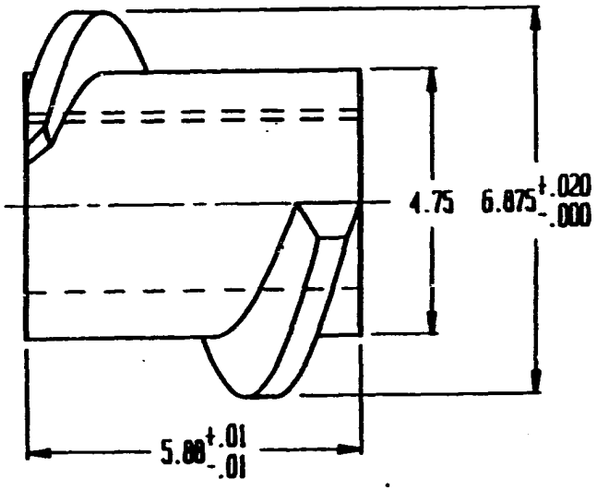


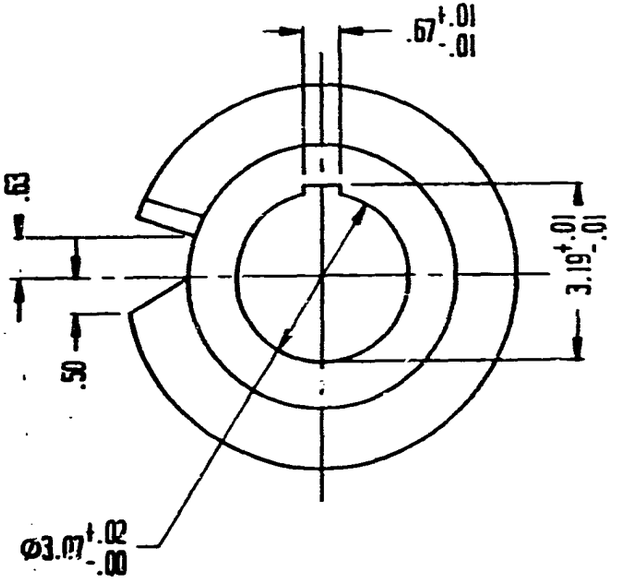
Notes:

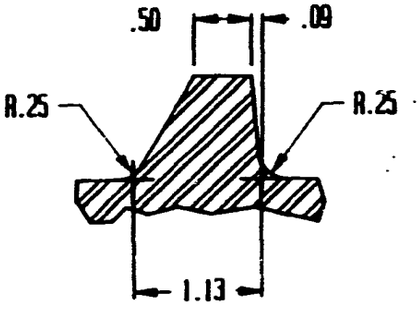
1. Pitch of Flight 4-3/8"
2. Hub Material, Shaft steel
3. Leading Edge "A" and Flight O.D. to be Special Hard Weld Rod Minimum 1/8" Thick
4. Trailing Edge "B" to be A6 Rod
5. Bore and O.D. Must be Concentric Within +/- .005 and End Faces Must be Square to Bore by .005 T.I.R.



EOPD, RANGOON BURMA		
SCALE 6"=1'-0"		DRAWN BY: BRZ
DATE 9/1/88		REVISED
Pressing Worm 4-3/8" Long X 6-7/8" Dia.		
Machining Drawing		DRAWING NUMBER 40114



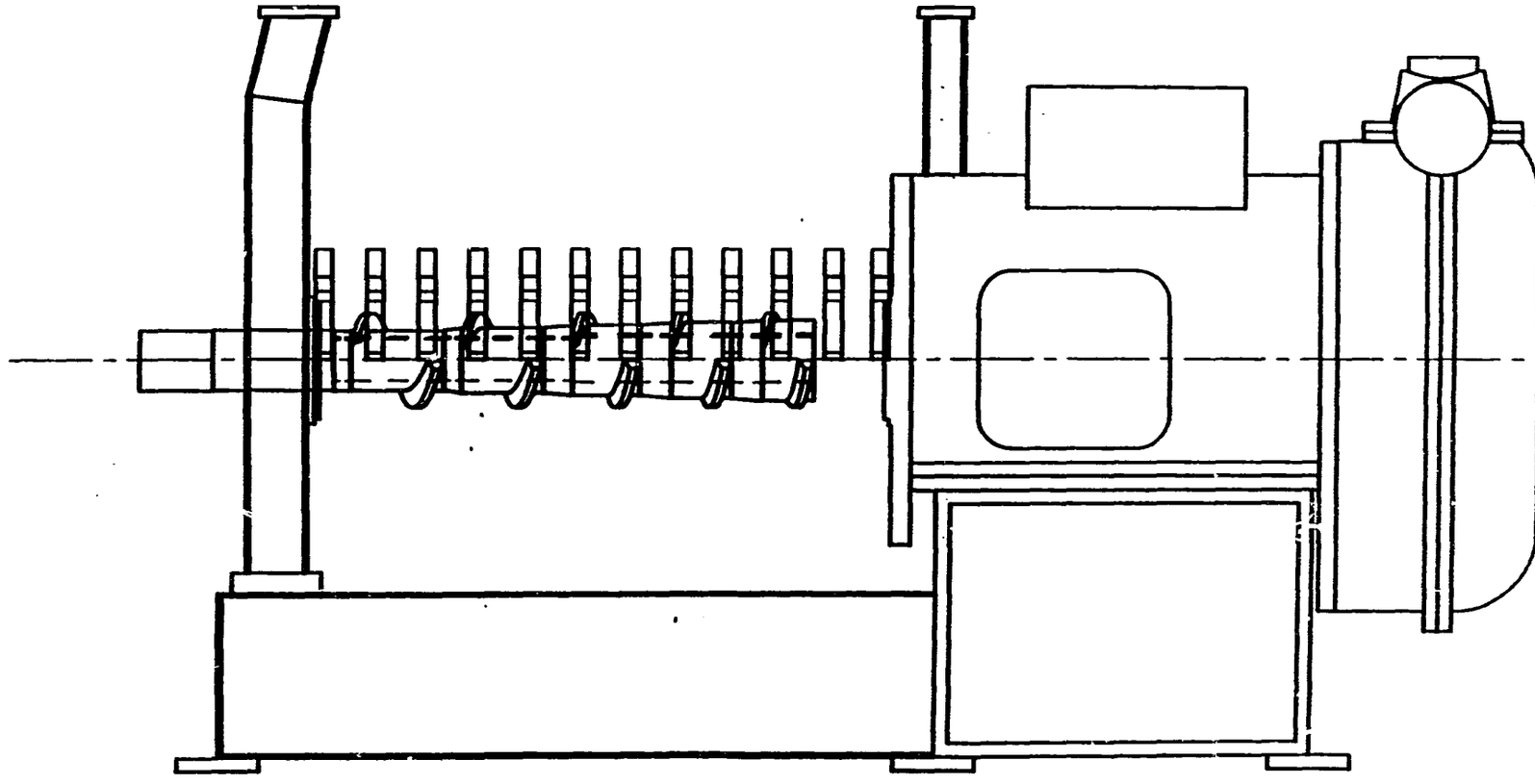




Notes: Material Cast Iron Alloy
.4 % Nickle
.2 % Chrome
Proceedures
1. Machine
2. Quench at 1700F in Brine (10%)
3. Stress Releive at 600F for 1 Hour

EOPD, RANGOON BURMA	
SCALE 6"=1'-0"	DRAWN BY DRZ
DATE 9/1/88	REVISED
Pressing Worm 5-7/8" Long X 6-7/8" Dia.	
Machining Drawing	DRAWING NUMBER 40019

187



EOPD, RANGOON BURMA

SCALE None

DATE 9/1/88

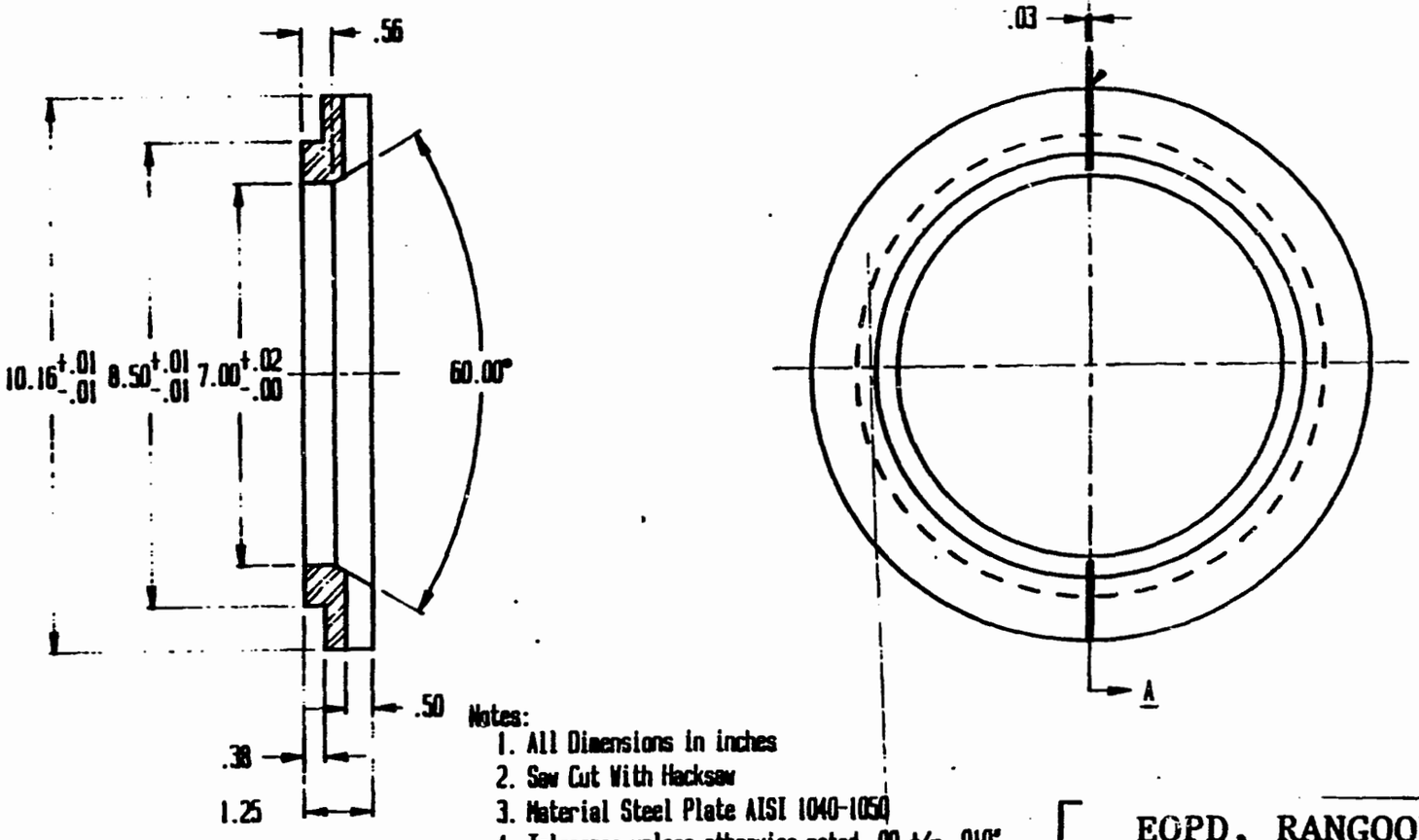
DRAWN BY DRZ

REVISED

EP Layout

DRAWING NUMBER

8000i



Crossection "A" - "A"

Notes:
1. All Dimensions in inches
2. Saw Cut With Hacksaw
3. Material Steel Plate AISI 1040-1050
4. Tolerence unless otherwise noted .00 +/- .010"
5. Carburize at 1700F for 4 hours
6. Quench at 1700F in Brine (10%)

EGPD, RANGOON BURMA

SCALE 6"=1'-0"	DRAWN BY DEZ
DATE 9/1/88	REVISED

Discharge End Split Ring

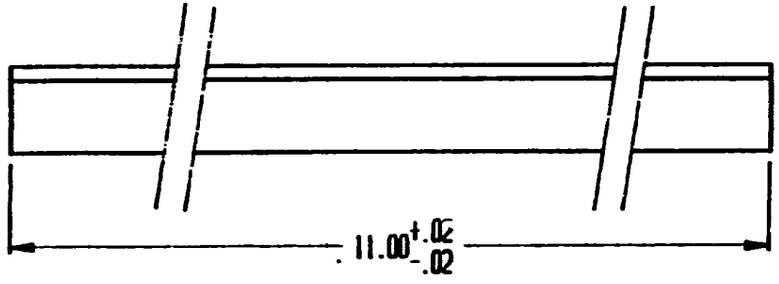
Machining Drawing

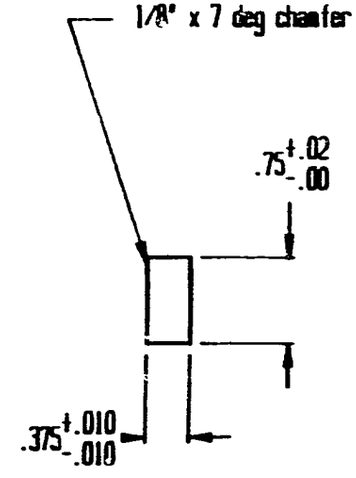
DRAWING NUMBER 10001

10

Material in use in Burma: HRS formed,
machined, and quenched
AISI 1075 (Truck Spring Steel)
Expected hardness: 45-50 Rc

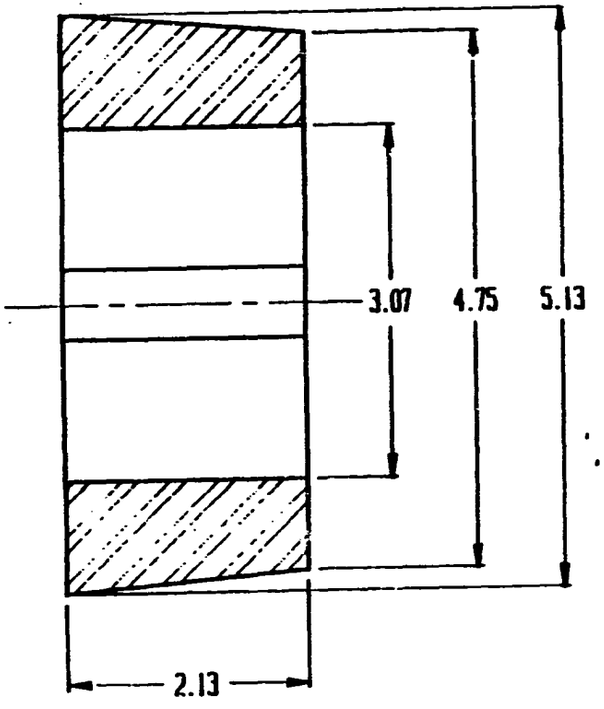
Desired Specifications:
Carburize to .04"-.05" depth
Heat Treated Hardness 58-62 Rc



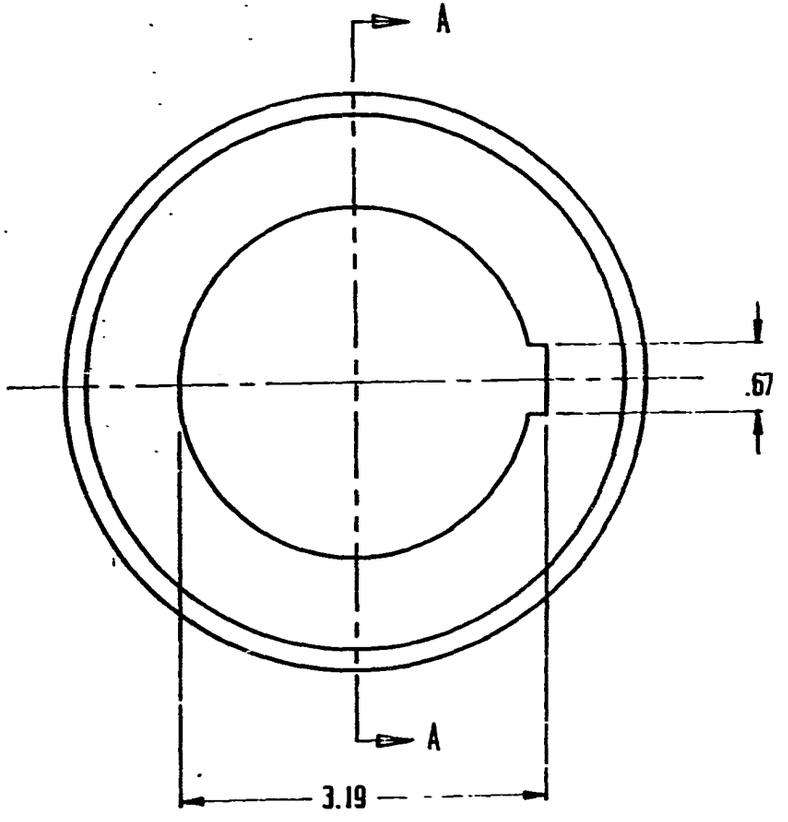


EOPD, RANGOON BURMA

SCALE FULL	DRAWN BY DRZ
DATE 9/1/88	REVISED
Cage Bar 3/8" x 3/4"	
Machining Drawing	DRAWING NUMBER 10026



Section A - A

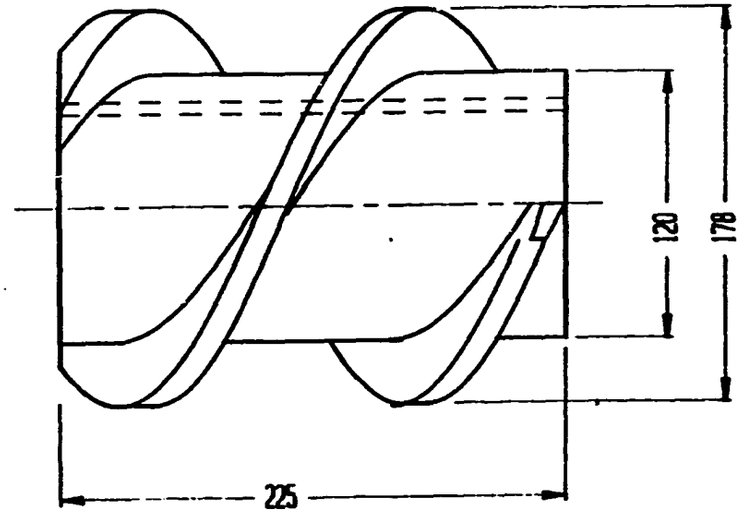


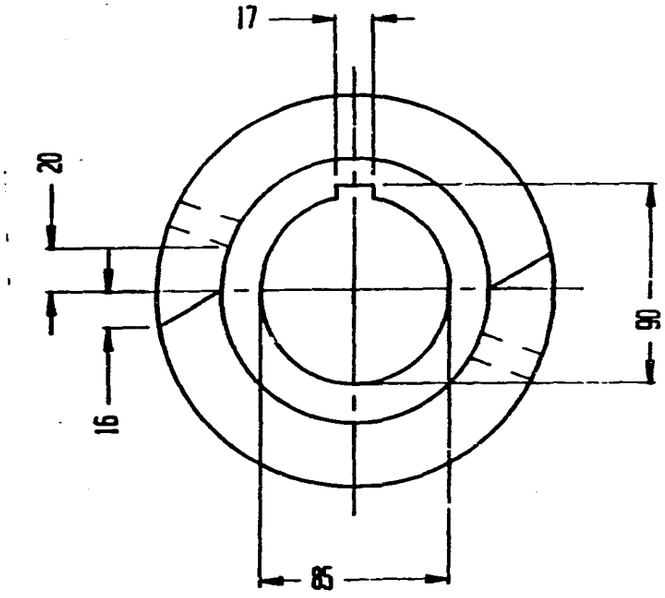
Notes:

1. Material AISI 1045 Heat-treated
2. Heat-treat to 55-62 RC
3. Depth of Penetration .06"
4. Tolerance unless noted .00 = +/- .01

EOPD, RANGOON BURMA

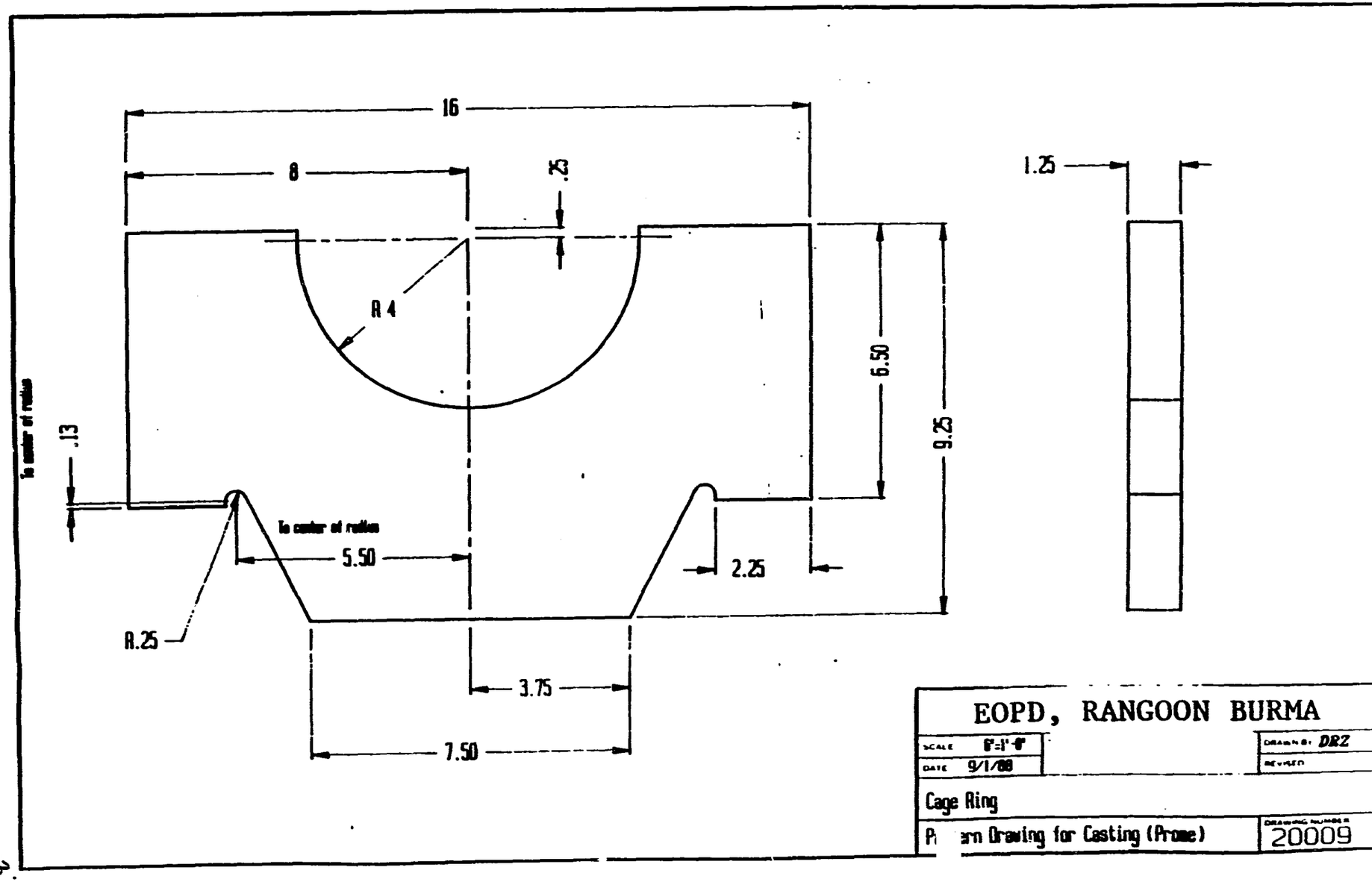
SCALE FULL	DRAWN BY DRZ
DATE 9/1/00	REVISED
Tapered Collar 4-3/4" to 5-1/8" x 2-1/8" lg	
Machining Drawing	DRAWING NUMBER 40005

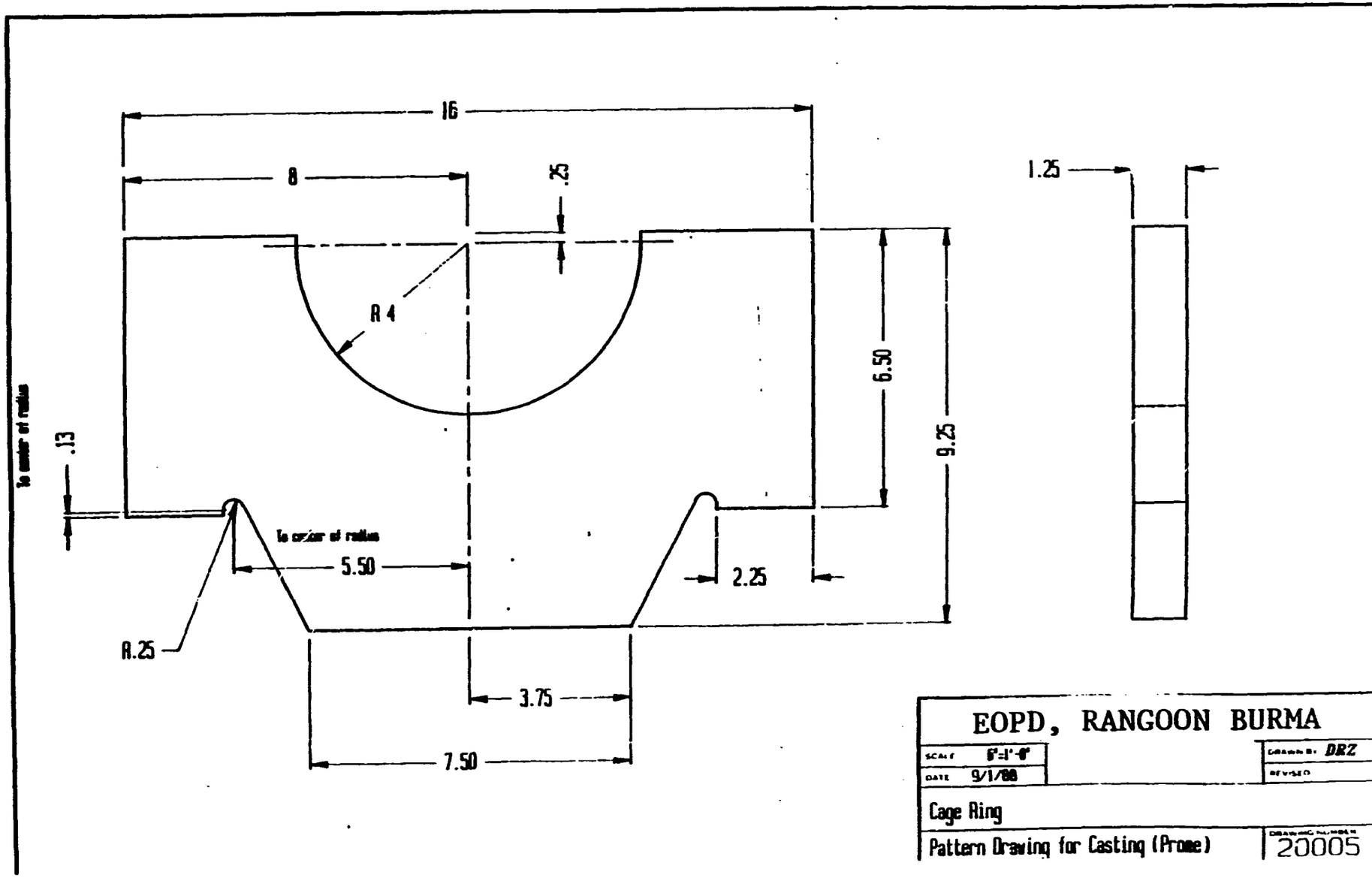




EOPD, RANGOON BURMA	
SCALE 6"=1'-0"	DRAWN BY DRZ
DATE 9/1/88	REVISED
Double Flight EP Feed Worm	
	DRAWING NUMBER 40004

1/2


16
8
.25
1.25
R 4
6.50
9.25
.13
To center of radius
To center of radius
5.50
2.25
R.25
3.75
7.50
EOPD, RANGOON BURMA
SCALE 6"=1'-0"
DATE 9/1/88
DRAWN BY DRZ
REVISED
Cage Ring
Pattern Drawing for Casting (Prone)
DRAWING NUMBER
20009



EOPD, RANGOON BURMA

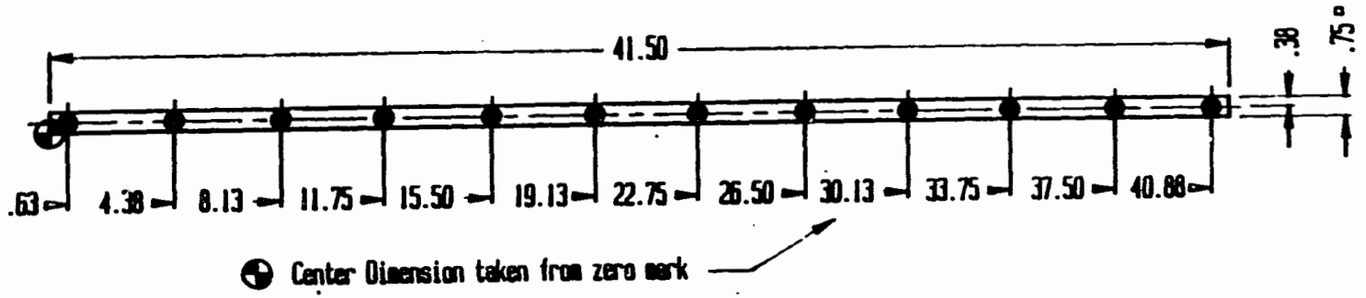
SCALE 6"=1'-0"	DRAWN BY: DRZ
DATE 9/1/88	REVISED

Cage Ring

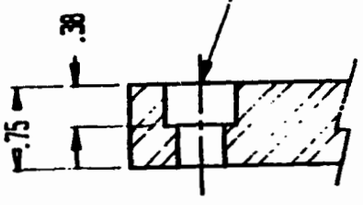
Pattern Drawing for Casting (Prone)

DRAWING NUMBER 20005

114.



13/32" Drill Thru
5/8" Dia CounterBore 3/8" Deep
12 Places
Along Center of Length



Detail of CounterBore
Full Scale

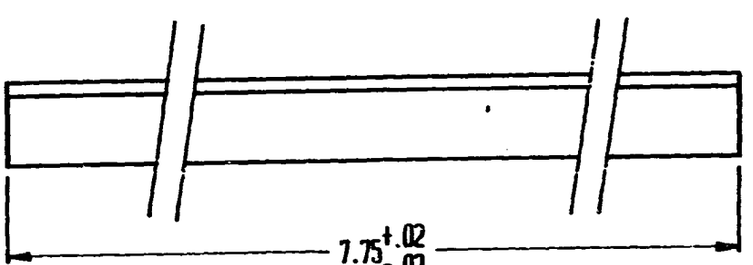
Notes:

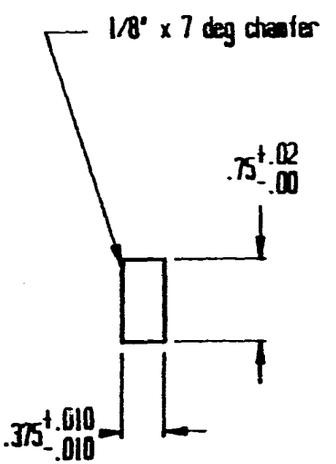
1. Material AISI 1045 Hot Rolled Steel
2. Break All Sharp Edges
3. All Dimensions in Inches
4. Tolerance unless otherwise noted is .00 +/- .010"

EOPD, RANGOON BURMA	
SCALE 3"=1'-0"	DRAWN BY DRZ
DATE 9/1/96	REVISED
Connecting Bar (PromeDAB)	
Machining Drawing	DRAWING NUMBER 20003

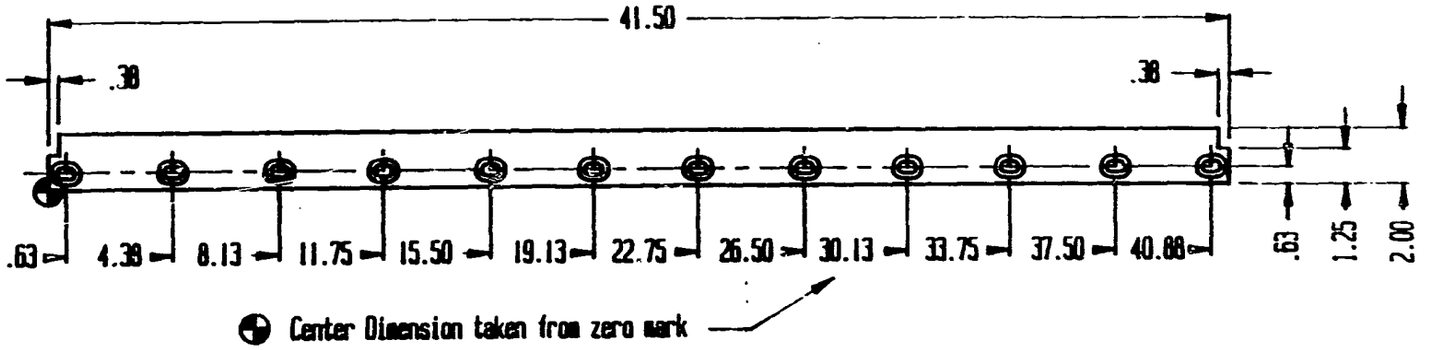
Material in use in Burma: HRS formed,
machined, and quenched
AISI 1075 (Truck Spring Steel)
Expected hardness: 45-50 Rc

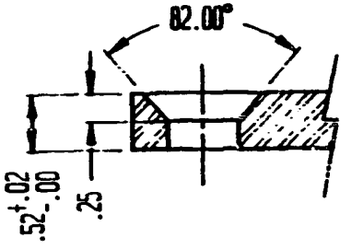
Desired Specifications:
Carburize to .04"-.06" depth
Heat Treated Hardness 58-62 Rc





EOPD, RANGOON BURMA	
SCALE FULL	DRAWN BY DRZ
DATE 9/1/88	REVISED
Cage Bar 3/8" x 3/4"	
Machining Drawing	DRAWING NUMBER 10025

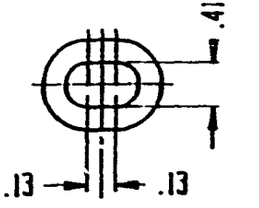




Counter Sink and Thickness
Detail - Full Scale

Notes:

1. Material AISI 1045 Hot Rolled Steel
2. Quench at 1700F in Brine (10%)
3. All Dimensions in Inches
4. Tolerence unless otherwise noted is .00 +/- .010"



Detail of Slotted Hole
Full Scale

EOPD, RANGOON BURMA	
Scale: 3" = 1'-0"	Drawn by: DRZ
Date: 9/1/88	Revised
Pressure bar (PromeDAB)	
Machining Drawing	Drawing number: 10021

Appendix O

Project Grant Agreement

APPENDIX L

PROJECT GRANT AGREEMENT

BETWEEN

THE SOCIALIST REPUBLIC OF THE UNION OF BURMA

AND THE

UNITED STATES OF AMERICA

for the

BURMA EDIBLE OIL PROCESSING AND DISTRIBUTION PROJECT

(482-0006)

Dated: August 29, 1985

A.I.D. Project No. 482-0006

Project Grant Agreement

Dated August 29, 1985

Between
The Socialist Republic of the Union of Burma ("Grantee")

And
The United States of America, acting through the Agency for International Development ("A.I.D.").

Article 1: The Agreement

The purpose of this Agreement is to set out the understandings of the parties named above ("Parties") with respect to the undertaking by the Grantee of the Project described below, and with respect to the financing of the Project by the Parties.

Article 2: The Project

SECTION 2.1 Definition of Project. The Project, which is further described in Annex 1, is designed to assist the Grantee in improving the efficiency and productivity of existing edible oil expeller facilities in both the private and cooperative sectors; and to strengthen the capabilities of the Ministry of Cooperatives and the cooperative sector in the planning and delivery of technical services. The Grant shall include, but not be limited to, provision of training, technical assistance, procurements of steel and other raw materials, spare parts, machinery and workshop equipment, as well as laboratory equipment and library reference material. Annex 1, attached, amplifies the above definition of the Project. Within the limits of the above definition of the Project, elements of the amplified description stated in Annex 1 may be changed by written agreement of the authorized representatives of the Parties named in Section 8.2, without formal amendment of this Agreement.

SECTION 2.2 Incremental Nature of Project

(a) A.I.D.'s contribution to the Project will be provided in increments, the initial one being made available in accordance with Section 3.1 of this Agreement. Subsequent increments up to a project total of $9,350,000 will be subject to availability of funds to A.I.D. for this purpose, and to the mutual agreement of the Parties, at the time of a subsequent increment, to proceed.

(b) Within the overall Project Assistance Completion Date stated in this Agreement, A.I.D., based upon consultation with the Grantee, may specify in Project Implementation Letters appropriate time periods for the utilization of funds granted by A.I.D. under an individual increment of assistance.

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Article 4: Conditions Precedent to Disbursement

SECTION 4.1 First Disbursement. Except as A.I.D. may otherwise agree in writing, prior to any disbursement for the upgrading of oilseed mills and related technical assistance or the issuance of any documentation pursuant to which disbursement will be made, the Grantee shall furnish, in form and substance satisfactory to A.I.D. a statement identifying the various agencies and offices of the Grantee responsible for implementation of the Project and designating individuals in each such agency or office responsible for coordinating Project components.

SECTION 4.2. Procurement of Laboratory Equipment. Except as A.I.D. may otherwise agree in writing, prior to any disbursement for the procurement of laboratory equipment, and the bench-type solvent extraction plant, or the issuance of any documentation pursuant to which disbursement will be made, The Grantee shall furnish to A.I.D., in form and substance satisfactory to A.I.D., evidence that the new laboratory facility of the Cottage Industries Department of the Ministry of Cooperatives is functional (with operating utilities and program safety equipment on line); a listing of staff that will be trained to use new equipment; and a listing of laboratory equipment and materials to be used.

SECTION 4.3 Notification. When A.I.D. has determined that the conditions precedent specified in Section 4.1 and 4.2 have been met, it will promptly notify the Grantee.

SECTION 4.4 Terminal Dates for Conditions Precedent. If all of the conditions specified in Section 4.1 and 4.2 have not been met within 90 days from the date of this Agreement, or such later date as A.I.D. may agree to in writing, A.I.D., at its option, may terminate this Agreement by written notice to the Grantee.

Article 5: Special Covenants

SECTION 5.1. Project Evaluation. The Parties agree to establish an evaluation program as part of the Project. Except as the Parties otherwise agree in writing, the program will include, during the implementation of the Project and at one or more points thereafter:

(a) evaluation of progress toward attainment of the objectives of the Project;

(b) identification and evaluation of problem areas or constraints which may inhibit such attainment;

(c) assessment of how such information may be used to help overcome such problems; and

(d) evaluation, to the degree feasible, of the overall development impact of the Project.

regulations in force in Burma); the motor vehicle should not exceed 2000 cc engine capacity and should be imported within 12 months after the first arrival of the personnel concerned in Burma;

(iv) The Grantee shall permit the said personnel and their families to enter Burma free of charge, and shall promptly issue residency visas and all other appropriate entry, exit or work visas, permits and identity documents necessary to enable such personnel and their families to reside and carry out their duties in Burma until the Project is completed;

(v) The Grantee will facilitate movement of project supplies by providing appropriate customs and wharfage facilities in the port closest to the project site and will be responsible for expeditious transport of such supplies to the project site;

(vi) The Grantee shall assume all liability for and shall hold such experts and their families harmless from all claims and liabilities resulting from performance of their assigned duties or residence in Burma, except as caused by wilful misconduct or gross negligence;

(vii) The Grantee will arrange for the safety of the Project personnel, project and personal equipment both at the project location, in transit and on any other official or representational activity in Burma.

(viii) The Grantee shall provide such personnel and their families free medical care other than dental at Government hospitals;

(ix) The Grantee shall provide free furnished temporary lodging for the said personnel when first arriving in Burma and when travelling away from duty station. Residential accomodation at project site will be provided to the personnel and their families and will be financed under the Grant as described in Annex 1.

(x) The Grantee, however, will not be held liable for any injury or death caused to the personnel assigned to the Project by accidents arising out of and in the course of their employment in Burma. Such foreign personnel are expected to be covered by insurance in connection with their assignment in accordance with the laws of his country.

(g) Trainees: The Grantee shall require all Burmese Government employees trained under the Project to serve in positions relevant to their training for periods of time at lease equal to the length of their training, under Burmese Government rules and regulations.

Article 6: Procurement Source

SECTION 6.1. Foreign Exchange Costs. Disbursements pursuant to Section 7.1 will be used exclusively to finance the costs of goods and services required for the Project having, with respect to goods, their source and origin, and with respect to services their nationality, in the United States (Code 000 of the A.I.D. Geographic Code Book as in effect at the time order are placed or contracts entered into for such goods and

(b) The local currency needed for such disbursements may be obtained by acquisition by A.I.D. with U.S. dollars by purchase, or from local currency already owned by the U.S. Government. The U.S. dollar equivalent of the local currency made available hereunder will be the amount of U.S. dollars required by A.I.D. to obtain the local currency.

SECTION 7.3. Other Forms of Disbursement. Disbursements of the Grant may also be made through such other means as the Parties may agree to in writing.

Article 8: Miscellaneous

SECTION 8.1. Communications. Any notice, request, document or other communication submitted by either Party to the other under this Agreement will be in writing or by telegram or cable, and will be deemed duly given or sent when delivered to such Party at the following address:

To the Grantee:

Director General
Cottage Industries Department
Ministry of Cooperatives
Rangoon

To A.I.D.:

A.I.D. Representative
Embassy of the United States of America
Rangoon.

All such communications will be in English, unless the Parties otherwise agree in writing. Other addresses may be substituted for the above upon the giving of notice. The Grantee, in addition, will provide USAID/Rangoon with a copy of each communication sent to A.I.D.

SECTION 8.2. Representatives. For all purposes relevant to this Agreement, the Grantee will be represented by the individual holding or acting in the Office of the Director General, Cottage Industries Department and A.I.D. will be represented by the individual holding or acting in the Office of A.I.D. Representative, U.S. Embassy, Rangoon, each of whom, by written notice, may designate additional representatives for all purposes other than exercising the power under Section 2.1 to revise elements of the amplified description of the project in Annex 1. The names of the representatives of the Grantee, with specimen signatures, will be provided to A.I.D., which may accept as duly authorized any instrument signed by such representatives in implementation of this Agreement, until receipt of written notice of revocation of their authority.

SECTION 8.3. Standard Provisions Annex. A "Project Grant Standard Provisions Annex" (Annex 2) is attached to and forms part of this Agreement.

Burma Edible Oil Processing and Distribution Project

A. SUMMARY PROJECT DESCRIPTION

The Burma Edible Oil Processing and Distribution Project is designed to upgrade and expand edible oil processing in Burma and support the activities planned under the Maize and Oilseeds Production Project (482-0005) over a five year period by focusing on: (a) increasing the capabilities of the Ministry of Cooperatives (MOC) to plan, implement, monitor and evaluate projects, (b) instituting greater management/ production measures in the Industrial Producers' Cooperatives, (c) upgrading the efficiency of edible oil processing in both the private and cooperative sectors, and (d) improving the quality of edible oil produced, and (e) improving edible oil distribution.

The project purpose will be accomplished in two ways. The first is by providing technical assistance and training to increase the capability of indigenous organizations to plan, implement and evaluate programs to improve production, quality and distribution of edible oil. The project will finance long-term training for 5 MSc's and 6 one-year training participants in the U.S. An additional 20 participants will receive short-term specialty training in the U.S. and 45 participants will be sent on observation tours to other countries in the Asia region. Technical assistance will be provided for 120 months long-term and 36 months short-term. The second method of accomplishing the project purpose will be by providing raw materials, equipment and commodities required to reproduce components for the rehabilitation of oilseed mills. The total life of project budget is estimated at $14.094 million of which AID will provide 66 percent ($9.35 million) and the Government of Burma will provide 34 percent ($4.744 million in kyat equivalent) subject to the availability of funds to each of the Parties.

The project is designed to be implemented over six years.

B. DETAILED PROJECT DESCRIPTION

1. Project Goal: The goal of the Burma Edible Oil Processing and Distribution Project is to attain self-sufficiency in edible oil production by increasing the quality and quantity of edible oil produced and distributed in Burma.

2. Project Purpose: The purpose of the project will be to upgrade and expand existing oil mills and increase the capability of indigenous organizations to undertake programs to improve edible oil processing and distribution. Specifically the project will focus on: (a) increasing the capabilities of the Ministry of Cooperatives (MOC) to plan, implement, monitor and evaluate projects, (b) instituting greater

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Four of these workshops will carry out the rehabilitation, manufacture or repair of screw-press mill components under the project. These four are located in the same areas as the 15 oilseed mill sample selected for analysis. The only workshop that will not participate in the project will be the Industrial Producers' Cooperative in Rangoon.

4. Project Outputs and End of Project Status:

a. Upgraded Planning Division (PD) of the MOC. Under the Cooperative Department of the Ministry of Cooperatives, the Planning Division is responsible for research, data collection and analysis, economic planning, coordination of donor inputs, and major project preparation. The Planning Division is now staffed with 33 people (85% hold B.Sc. degrees), but this number is expected to significantly increase over the next two or three years. An internal appraisal of the Planning Division concluded that it has skill deficiencies in certain areas of its responsibility.

The Planning Division's skills in data collection, storage, retention and analysis will be greatly enhanced under the project; so will its project preparation, appraisal, monitoring, and evaluation. By the end of the project, the Planning Division should be more fully staffed with skillful professionals supported by appropriate equipment and tools to carry out their responsibilities.

b. Upgraded Cottage Industries Department (CID) of the MOC. The Cottage Industries Department currently has 298 positions and a pending reorganization would further increase staff levels. The divisions of the Cottage Industries Department that will receive assistance under the project are the Innovation, the Technical Services, and the Training and Education Divisions.

The Innovation Division is responsible for quality control of the cooperatives' edible oil and for the development of new and the adaptation of existing technologies (such as the development of weaning foods) for cooperative products. It is staffed by chemists, physicists, botanists and engineers. It also maintains a quality control laboratory.

The Technical Service Division is responsible for such things as physical plant design, assistance with technical problems, upgrading of existing plants, and the construction of new plants. These two divisions channel their services to local evel plants and entities through the Training and Education Division, which has branches all over the country.

The Training and Education Division maintains a technical library for CID, and provides training in edible oil technology to cooperatives through seminars, symposia, in-country programs, and practical problem solving at site facilities.

The capabilities of the Cottage Industries Department will be greatly enhanced under the project, which will enable it and its divisions to

Proposed Training for Ministry of Cooperatives

Type	Entity	No. of Persons	Person/ months	Skill areas
Short term	PD	15	40	Data collection, analysis, computer programming, marketing project design, macro and sector planning
Short term	CID	10	30	Solvent operations, instrumentation, metallurgy, nutrition, quality control
Long term	PD	1	24	Financial analysis and macro-economic planning
Long term	CID	10	168	Chemistry, metallurgy, quality control, nutrition, packaging, solvent extraction
Observation Tours	MOC Coop	45	45	Oil extraction, oil expelling, refining, bottling, distribution

(2) Technical Assistance. Technical Assistance (TA) will be provided through the MOC to its subordinate entities and to workshops and screw-press mills, both cooperative and private. The TA will consist of two distinct parts: long-term and short-term. Long-term technical assistance advisors will be stationed in Burma and will work with the involved entities on a daily basis. The efforts and expertise of these resident advisors will be augmented by short-term experts who will visit Burma for short durations.

Long-term TA will consist of 10 person-years to be provided through the Cottage Industries Department during the life of the project. The TA team will consist of three persons, a team leader and two other experts. The team leader will be an expert in oil extraction and refining and will oversee the overall TA effort for the four years (48 months) of the project implementation. The team leader will work with other members of the team and with project entities in defining and arranging for short-term TA and training requirements. The other two experts will be qualified master mechanics who will work with the workshops and screw-press mills in manufacturing mill parts and in rehabilitating, maintaining, and operating these mills. A total of 72 person-months of services will be required from the master mechanics, or a total or 120 person-months of long-term TA.

b. Host Country Inputs. The project inputs to be provided through funding by the Burmese Government are summarized below:

(1) Port handling costs and inland freight for all imported items under the project.

(2) Land and buildings for production and processing activities, office space, a limited number of vehicles, and in-country travel.

(3) Salaries for trainees and replacements, supervisors and support staff, language training and other local costs, financial and in-kind including loan administration costs associated with the project.

(4) Utilities, support staff, office space, vehicles and drivers, office equipment and suppliers, and in-country travel for the technical assistance team.

(5) Local expenditures for laboratory and library supplies and facilities, including administrative and operating costs of the facilities.

(6) Operation and maintenance costs by four Workshops and 60 oil mills for fabrication, rehabilitation, and annual rebuilding and maintenance of expeller parts.

6. Interaction of Project Entities. AID grant funds will be used to procure the services and commodities listed. The Burmese Government, in turn, will grant the value of the services portion of AID inputs (technical assistance and training) to the Cooperative Workshops and the mills. The Government will also grant the value of all commodities, training and technical assistance to the MOC or its subdivisions. The rest of the commodities will be made available to the four Cooperative Workshops and the mills on a loan basis, and will include C.I.F. Rangoon prices of all commodities plus any import duties and taxes. The terms of the foreign exchange portion of the loan will be similar to the terms and conditions which are applicable to the projects implemented by the Cooperatives under bilateral grant assistance. The loans to the Workshops and mills will be administered by the MOC project management team through the Myanma Economic Bank. Debt service payments by the Workshops and mills will be made to that bank.

The Workshops will utilize their newly acquired and original equipment and materials to manufacture screw-mill parts and components and will assist the mills in major rehabilitation efforts. The Workshops will provide their services to all participating mills. The availability of workshop services to all mills will be a condition of their participation in the project. Charges made to mills will be the same.

ILLUSTRATIVE LIFE OF PROJECT BUDGET
(U.S.$ '000)

Source	AID		HOST COUNTRY		TOTAL
	FX	LC	FX	LC	
Technical Assistance	1,986	300	--	161	2,447
Training	861	--	--	133	994
Equipment and Commodities:[1]					
for Workshops and Mills	3,360	--	--	200	3,560
for Ministry of Cooperatives	865	--	--	--	865
Operations and Maintenance	--	--	--	4,199	4,199
Contractor Support Costs	--	200	--	30	230
Evaluation	250	--	--	21	271
Inflation	478	--	--	--	478
Contingency	1,050	--	--	--	1,050
TOTAL	8,850	500	--	4,744	14,094

[1] includes installation, maintenance and service charges

FX = Foreign Exchange Expenditures

LC = Local Currency (Kyat) Expenditures

D. ADMINISTRATIVE ARRANGEMENTS AND TECHNICAL ASSISTANCE TEAM

1. Overview: The three major actors in project implementation and monitoring, the MOC, AID/Burma, and the TA consultant, will coordinate closely at all stages of the project. Therefore, a coordinating mechanism such as regular meetings to assess progress and identify and relieve constraints, will be adopted.

The roles of the three major actors are discussed below.

2. Host Country Role: Primary coordination for the project will be with the Ministry of Planning and Finance and in particular with the Director-General of the Foreign Economic Relations Department. Overall responsibility for managing and implementing the project rests with the Ministry of Cooperatives which consists of two major departments:

a. The Cooperative Department which is responsible for the expansion and development of cooperatives in Burma and for statutory functions; and

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arrival. The local costs of rental, renovation, repairs, maintenance, and utilities for permanent housing for the TA team are included in the budget.

AID/Burma, using funds not included in this Agreement, will also purchase, import and register through the U... Embassy vehicles and household durables needed for support of the TA team. AID/Burma will retain title to such items until they are no longer required to support A.I.D.-financed personnel assigned in Burma and such items shall be transferred to the Grantee free-of-charge after completion of the project.

5. Procurement Services Agent (PSA): The Procurement Services Agent will be responsible for the actual procurement of project commodities, and will follow AID procurement procedures which are outlined in the Procurement Plan of this Project Paper (see Procurement Plan, below).

E. Training

The AID Office will work with the MOC to identify as many of the eleven long-term training candidates as possible at the earliest possible time. Every effort will be made to place qualified candidates in appropriate U.S. institutions as early as possible. This initial number will be selected for study beginning the spring semester of 1986. A second group of long-term trainees will be placed beginning the fall of 1986. The remaining trainees will be admitted subsequently as they are identified and have achieved English language proficiency. Those candidates who do not have the required English language capacity will be provided some short-term training at the expense of the MOC. All long-term candidates should be in training not later than the fall semester of 1987. The AID Office will preapre PIO/P's to cover all long-term training and the Office of International Training will assist in processing and backstopping these candidates. Approximately 20 candidates from the MOC will be selected for short-term training and 45 for observation tours. Short-term training will involve periods anywhere from 1-4 months per person, and will include academic courses, seminars conducted by other than universities, on-the-job training, familiarization tours, etc. The exact training vehicle will be selected to meet the particular requirements of the candidate and the training objective.

The same procedures will apply to short-term training. However, in all cases, short-term training will be conducted in accordance with a training plan based on the recommendations of the TA team. The TA team will be responsible for all short-term training and their home office will assist in the identification of suitable courses and other training possibilities to meet the goal of the training. Short-term training could be conducted in the U.S. or in third countries. It is anticipated that the majority of this training will take place in the U.S.

6. In-Country Training: The TA team will also be responsible for conducting a program of training in Burma to upgrade existing skills and prepare a cadre of trained officers to complement out-of-country training

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4. Procurement Plan: AID grant-financed purchases under this project will include approximately $1,495,000 worth of workshop equipment and machinery, $1,622,800 for steel, boilers, spare parts and supplies for the oil mills to be upgraded, $50,000 for decorticators, $115,000 for laboratory equipment, $500,000 for a model solvent extraction plant/refinery, $100,000 for library reference materials, $105,000 for household furnishings and furniture, and $78,000 for vehicles. Including procurement and shipping, total U.S. financed commodity costs are $4,325,000. All procurements will be made according to AID regulations and good commercial practice. The Burmese Government will be responsible for Burmese customs clearance and transport of commodities to project sites. As stated in Section 6.1, the source and origin of all commodities purchased with foreign exchange shall be the U.S., unless AID agrees otherwise in writing. All commodities shall be shipped on U.S. Flag Vessels, unless AID agrees otherwise in writing (See Section 6.1 and Standard Provision C.6.).

Project Grant Standard Provisions Annex

Definitions: As used in this Annex, the "Agreement" refers to the Project Grant Agreement to which this Annex is attached and of which this Annex forms a part. Terms used in this Annex have the same meaning or reference as in the Agreement.

Article A: Project Implementation Letters

To assist Grantee in the implementation of the Project, A.I.D., from time to time, will issue Project Implementation Letters that will furnish additional information about matters stated in this Agreement. The parties may also use jointly agreed-upon Project Implementation Letters to confirm and record their mutual understanding on aspects of the implementation of this Agreement. Project Implementation Letters will not be used to amend the text of the Agreement, but can be used to record revisions or exceptions which are permitted by the Agreement, including the revision of elements of the amplified description of the Project in Annex 1.

Article B: General Covenants

SECTION B.1. Consultation. The Parties will cooperate to assure that the purpose of this Agreement will be accomplished. To this end, the Parties, at the request of either, will exchange views on the progress of the Project, the performance of obligations under this Agreement, the performance of any consultants, contractors, or suppliers engaged on the Project, and other matters relating to the Project.

SECTION B.2. Execution of Project. The Grantee will:

(a) carry out the Project or cause it to be carried out with due diligence and efficiency, in conformity with sound technical, financial, and management practices, and in conformity with those documents, plans specifications, contracts, schedules or other arrangements, and with any modifications therein, approved by A.I.D. pursuant to this Agreement; and

(b) provide qualified and experienced management for, and train such staff as may be appropriate for the maintenance and operation of the Project, and, as applicable for continuing actvities, cause the Project to be operated and maintained in such manner as to assure the continuing and successful achievement of the purposes of the Project.

SECTION B.3. Utilization of Goods and Services.

(a) Any resources financed under the Grant will, unless otherwise agreed in writing by A.I.D., be devoted to the Project until the completion of the Project, and thereafter will be used so as to further the objectives sought in carrying out the Project.

Article B: General Covenants (Continued)

(c) afford authorized representatives of a Party the opportunity at all reasonable times to inspect the Project, the utilization of goods and services financed by such Party, and books, records, and other documents relating to the Project and the Grant.

SECTION B.6. Completeness of Information. The Grantee confirms:

(a) that the facts and circumstances of which it has informed A.I.D., or caused A.I.D. to be informed, in the course of reaching agreement with A.I.D. on the Grant, are accurate and complete, and include all facts and circumstances that might materially effect the Project and the discharge of responsibilities under this Agreement.

(b) that it will inform A.I.D. in timely fashion of any subsequent facts and circumstances that might materially affect, or that it is reasonable to believe might so affect, the Project or the discharge of responsibilities under this Agreement.

SECTION B.7. Other Payments. Grantee affirms that no payments have been or will be received by any official of the Grantee in connection with the procurement of goods or services financed under the Grants, except fees, taxes, or similar payments legally established in the country of the Grantee.

SECTION B.8. Information and Marking. The Grantee will give appropriate publicity to the Grant and the Project as a program to which the United States has contributed, identify the Project site, and mark goods financed by A.I.D., as described in Project Implementation Letters.

Article C: Procurement Provisions

SECTION C.1. Special Rules.

(a) The source and origin of ocean and air shipping will be deemed to be the ocean vessel's or aircraft's country of registry at the time of shipment.

(b) Premiums for marine insurance placed in the territory of the Grantee will be deemed an eligible Foreign Exchange Costs, if otherwise eligible under Section C.7(a).

(c) Any motor vehicles financed under the Grant will be of United States manufacture, except as A.I.D. may otherwise agree in writing.

(d) Transportation by air, financed under the Grant, of property or persons, will be on carriers holding United States certification, to the extent service by such carriers is available. Details on this requirement will be described in a Project Implementation Letter.

SECTION C.5. Notification to Potential Suppliers. To permit all United States firms to have the opportunity to participate in furnishing goods and services to be financed under the Grant, the Grantee will furnish A.I.D. such information with regard thereto, and at such times, as A.I.D. may request in Project Implementation Letters.

SECTION C.6. Shipping.

(a) Goods which are to be transported to the territory of the Grantee may not be financed under the Grant if transported either: (1) on an ocean vessel or aircraft under the flag of a country which is not included in A.I.D. Geographic Code 935 as in effect at the time of shipment; or (2) on an ocean vessel which A.I.D. by written notice to the Grantee has designated as ineligible; or (3) under an ocean or air charter which has not received prior A.I.D. approval.

(b) Costs of ocean or air transportation (of goods or persons) and related delivery services may not be financed under the Grant, if such goods or persons are carried: (1) on an ocean vessel under the flag of a country not, at the time of shipment, identified under the paragraph of the Agreement entitled "Procurement Souce: Foreign Exchange Costs," without prior written A.I.D. approval; or (2) on an ocean vessel which A.I.D., by written notice to the Grantee, has designated as ineligible; or (3) under an ocean vessel or air charter which has not received prior A.I.D. approval.

(c) Unless A.I.D. determines that privately owned United States-flag commercial ocean vessels are not available at fair and reasonable rates for such vessels, (1) at least fifty percent (50%) of the gross tonnage of all goods (computed separately for dry bulk carriers, dry cargo liners and tankers) financed by AI.D. which may be transported on ocean vessels will be transported on privately owned United States-flag commercial vessels, and (2) at least fifty percent (50%) of the gross freight revenue generated by all shipments financed by A.I.D. and transported to the territory of the Grantee on dry cargo liners shall be paid to or for the benefit of privately owned United States-flag commercial vessels. Compliance with the requirements of (1) and (2) of this subsection must be achieved with respect to both any cargo transported from U.S. ports and any cargo transported from non-U.S. ports, computed separately.

SECTION C.7. Insurance

(a) Marine insurance on goods financed by A.I.D. which are to be transported to the territory of the Grantee may be financed as a Foreign Exchange Cost under this Agreement provided (1) such insurance is placed at the lowest available competitive rate, and (2) claims thereunder are payable in the currency in which such goods were financed or in any freely convertible currency. If the Grantee (or government of Grantee), by statute, decree, rule, regulation, or practice discriminates with respect to A.I.D.-financed procurement against any marine insurance company authorized to do business in any State of the Unites States, then

(b) If the failure of Grantee to comply with any of its obligations under this Agreement has the result that goods or services financed under the Grant are not used effectively in accordance with this Agreement, A.I.D. may require the Grantee to refund all or any part of the amount of the disbursements under this Agreement for such goods or services in U.S. Dollars to A.I.D. within sixty days after receipt of a request therefor.

(c) The right under subsection (a) or (b) to require a refund of a disbursement will continue, notwithstanding any other provision of this Agreement, for three years from the date of the last disbursement under this Agreement.

(d) (1) Any refund under subsection (a) or (b), or (2) any refund to A.I.D. from a contractor, supplier, bank or other third party with respect to goods or services financed under the Grant, which refund relates to an unreasonable price for or erroneous invoicing of goods or services, or to goods that did not conform to specifications, or to services that were inadequate, will (A) be made available first for the costs of goods and services required for the Project to the extent justified, and (B) the remainder, if any, will be applied to reduce the amount of the Grant.

(e) Any interest or other earnings on Grant funds disbursed by A.I.D. to the Grantee under this Agreement prior to the authorized use of such funds for the Project will be returned to A.I.D. in U.S. Dollars by the Grantee.

SECTION 9.3. Nonwaiver of Remedies. No delay in exercising any right or remedy accruing to a Party in connection with its financing under this Agreement will be construed as waiver of such right or remedy.

SECTION 9.4. Assignment. The Grantee agrees, upon request, to execute an assignment to A.I.D. of any cause of action which may accrue to the Grantee in connection with or arising out of the contractual performance or breach of performance by a party to a direct U.S. Dollar contract with A.I.D. financed in whole or in part out of funds granted by A.I.D. under this Agreement.

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Appendix P

Logical Framework

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 85 to FY 89
Total U.S. Funding $9.5 Million
Date Prepared: November 1984

Project Title & Number: Edible Oil Processing and Distribution (482-0006)

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes:	Measures of Goal Achievement:		Assumptions for achieving goal targets:
To attain self-sufficiency in edible oil production.	Domestic edible oil production equals 20 pounds per capita (estimated to require production of 415,000 mt/yr. by 1994).	- Census and Statistics data - Agriculture Corporation Records - Ministry of Cooperative Records - Special Reports	- SEMO priorities on edible oil production and consumption remain unchanged. - Continued political/social stability and economic growth - Pricing relationships between oilseeds and other crops remain favorable.
Project Purpose: To upgrade and expand oil mills and increase the capability of indigenous organizations to plan, implement and evaluate programs to improve edible oil processing and distribution.	Conditions that will indicate purpose has been achieved: End of project status. 1. Oilseed mills processing 220% greater quantities of oilseeds than present (initial 15 mills processing 45,100 mt oilseeds by year 5). 2. Functioning technical and analytical libraries servicing NOC and cooperatives. 3. CIB laboratory implementing quality control testing for 50% of cooperatives. 4. Continuing in-country training program for oil extraction operators. 5. NOC has developed and is implementing a national program to improve edible oil production and distribution. 6. Trained staff performing functions appropriate to their training.	- Oilseed Mill's Financial Statement and Records - NOC Records - Project Records/Evaluation - Site Visits - Special Survey	Assumptions for achieving purpose: - Production of oilseeds does not decrease. - Mandate for cooperatives involvement in oilseed processing remains adequately strong to allow cooperatives to purchase adequate oilseeds. - That acceptable economic incentives are provided to combine in capturing adequate raw materials. - That inputs and technical services can be delivered as planned in an acceptable form - NOC able to recruit and retain quality personnel.

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PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 85 to FY 89
Total U.S. Funding $9.5 Million
Date Prepared: November 1984

Project Title & Number: Edible Oil Processing and Distribution (482-0006)

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Inputs:	Implementation Target (Type and Quality)	- Contractor Records and Reports	Assumption for providing inputs:
	1. AID	- NOC Records	- Conditions precedent are met on schedule.
	Technical Assistance	- Project Records	
	a. 10 py long-term resident technical advisors	- Project Audits	- Qualified participants are selected and processed on schedule.
	b. 36 pm short-term TA	- Site Visits	
	2. Training		- Contractor selection, procurement and staffing proceeds on schedule.
	a. 15 py 2 years MS degrees		
	b. 6 py 1 year training		- Commodities moved to project sites expeditiously.
	c. 70 pm short-term training		
	d. 45 pm observation tours		- Contingency allowance for escalation in costs of TA, training and commodities proves adequate to meet needs
	3. Equipment and Commodities		
	a. Equipment for Workshops ($1,495)		
	b. Materials for Mills ($1,625)		
	c. Beach Model Solvent Extraction Plant ($500)		
	d. Vehicles ($78)		
	e. Procurement Service Agent ($250)		
	f. Standard Reference Laboratory Equipment ($115)		
	g. Household Furnishings ($105)		
	h. Library Reference Materials ($109)		

Inputs:	AID	SRUB	TOTAL
Technical Assistance	2,546	161	2,707
Training	861	133	949
Equipment & Commodities	4,316	230	4,546
Operation & Maintenance	--	4,199	4,199
Evaluation	250	21	271
Inflation	478	--	478
Contingency	1,049	--	1,049
TOTAL	9,500	4,744	14,244

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY 85 to FY 89
Total U.S. Funding $9.5 Million
Date Prepared: November 1984

Project Title & Number: Edible Oil Processing and Distribution (482-0006)

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Outputs:	Implementation Target (Type and Quality)	- MOC Records	Assumptions for achieving outputs:
1. Rehabilitated screw-press oil mills processing at a minimum of 75% capacity with a recommended program of annual maintenance in place.	Oil Mills: 15 mills completely rehabilitated with an additional 30-45 mills to be upgrade to varying degrees.	- Project Records - Project Audits - Site Visits	- Responsible SEND and other employees will be identified and released for in country and overseas training.
2. Upgrade capacity and capability of workshops.	Library:		- Timing and quality of inputs to meet project requirements.
3. Returned participant trainees in place with MOC and other local organizations.	500 new books 20 periodical subscriptions 15 technical journals/publications		
4. Fully equipped and staffed reference laboratory.	Mill/Workshop Equipment/Materials:		
5. Fully equipped and staffed reference library in Cottage Industries Department.	Machine equipment ($1,495,000) Raw materials ($1,623,000) 6 vehicles		
6. Planning Division will be fully staffed (increase of ___) and selected participants trained.	Training Staff:		
7. CID Divisions; Innovation, Technical services, training and Education Divisions, trained in place.	6 MS degrees 7 other long-term trainees 30 short-term trainees 45 observation tour participants		
	Operating Laboratory:		
	$615,000 new equipment		

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