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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

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SYRIAN ARAB REPUBLIC

Technical report: Training and upgrading of technical capabilities*

Prepared for the Government of the Syrian Arab Republic
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Substantive Officer: R. Ramanantoanison
Training Branch

Backstopping Officer: G. Anestis
Section for Integrated Industrial Projects

Based on the work of J.C. Dukes, training expert in instrument maintenance and repair

United Nations Industrial Development Organization
Vienna

2.

* The views expressed in this paper are those of the author and do not necessarily reflect the views of the Secretariat of the United Nations Industrial Development Organization (UNIDO). Mention of company names and commercial products does not imply the endorsement of UNIDO. This document has not been edited.

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(i) EXPLANATORY NOTES

REF1 - REF7 Bibliography, list of references, see ANNEX 7

ACKNOWLEDGEMENTS

Special thanks are due to the staff and instructors at VTC Damascus in appreciation of their kind assistance and hospitality, also to the staff at UNDP Damascus for their close co-operation.

(ii) ABSTRACT

DEVELOPMENT OF TRAINING PROGRAMS IN MAINTENANCE OF ELECTRONIC/ELECTRIC CONTROL INSTRUMENTS UNDER THE MINISTRY OF INDUSTRY.

1 The objective was to set up a training programme in electronic and electric control instruments. To demonstrate troubls-shooting techniques in the field of industrial instrumentation. To define the requirements for appropriate training in the maintenance of industrial instrumentation and assist two fellowship candidates in making the best use of available facilities which they will encounter in Italy. To support the Syrian Arab Republic in it's plan for self reliance.

2 The duration of the mission was 2 months, 1st. July to 31 August 1989.

3 The main conclusion that may be drawn is that there has not been sufficient financial support, from any sources, to provide adequate demonstration equipment, calibration equipment and tools that are required to illustrate, demonstrate and practice repair and maintenance techniques. This adversely affects the ability of the companies within the Ministry of Industry to maintain equipment properly and undermines its intent of self reliance.

4 It is recommended that funds be acquired for the purchase of the already identified demonstration and calibration equipment and tools, methods must be investigated to acquire the funds or the items identified directly. This is the major barrier preventing the start of a viable control instrument training program.

(II) INTRODUCTION

5 As mentioned earlier, in the abstract, the objective was to set up and start a training programme in electronic and electric control instruments at VTC Damascus.

6 It was intended that there would be a demonstration of calibration and trouble-shooting techniques relying on the hands-on experience, the observation of the hardware with reference to instruction manuals and circuit diagrams. To allow instructors, already qualified in aspects of electrical/electronic theory, to go through the process of practical application of the theory, to be able to understand previously unknown equipment in the field of industrial instrumentation by practical analysis of the major parts. It was hoped that this would result in the formation of an appropriate training programme in the maintenance of industrial instrumentation for VTC students.

7 Unfortunately there is little or no industrial control equipment available at VTC, although there have been plans for the acquisition and installation of this type of equipment for over 5 years.

8 On investigation, documented information revealed that "In August 1981 until May 1983 a team of international experts prepared a syllabus and programme for 'Repairman in Industrial Electronics' (RIE)" (see REF6). "VTD did not suceed in introducing this training because of the inability to procure the equipment and prepare the specialized instructors etc." (REF3-para 2). "The course could have begun in early 1987" (REF3-para 9)."The material has not been obtained" (REF3-para 19).

9 The objectives of this mission were revised when progress on the original intent became impossible. It was decided to make a training course for the instructors (see ANNEX 3), based on what test equipment and physical hardware that did exist and to this

end the subjects of practical experiments were curtailed to logic circuits, small electric motors and synchro-motors (see ANNEX 2 for curriculum details).

10 In the process of running the above mentioned course of practical experiments, and subsequent to it, there was equipment that needed repair, this also became part of the course. Sometimes analysis of the equipment's maintenance procedures was useful in illustrating the need for planned maintenance, as was the case in the VTC's machine shop.

11 The two fellowship candidates needed assistance in making the best use of available facilities which they would encounter in Fermo, Italy for 3 months starting approximately 18 September 1989.

12 To make the best use the time and material available in Italy it is necessary to receive training on the types of equipment that exist in Syria at the present or will exist in the near future. To this end 5 plants, within or near to the Damascus area, were visited.

13 These plants are within The Ministry of Industry and are considered typical employers for VTC graduates. These visits helped focus the staff at VTC and the fellowship individuals on the complexity of maintenance and the types of equipment used in the field (see ANNEX 4). This should help them to acquire information and skills that can later be passed on to students within VTC.

14 During the visit to the plants, over the period of approximately 1 week, plant technicians and engineers sometimes highlighted their need for assistance and talked about problems that they had with regard to maintenance of industrial controls.

15 Where possible, advice and assistance was given. A brief report of each plant visit is given in the body of this report.

(III) RECOMMENDATIONS

Recommendations to THE MINISTRY OF INDUSTRY

16 Maintenance and repair of industrial equipment is, to a large degree, dependent on PRACTICAL experience. In (so-called) developed countries this practical experience is often gained by students dis-assembling and re-assembling mechanical and electro-mechanical items in an attempt to repair or improve the operation of the equipment or just to find out how it works.

17 Of course, it is taken for granted that there is a large supply of not-so-important equipment available for these practical experiments, some of the equipment, by the nature of the process, fail to be repaired or improved. Even in failure there is the opportunity for practical experience.

18 Repair technicians tend to develope their practical skills in conjunction with the theoretical part of any course; for many students the theory is of little importance until there is some hands-on experiential work. Over the years the skills of using touch, hearing and sight to determine how to maintain equipment is established.

19 There are generations of families involved in maintenance. For people who have done maintenance all their lives, maintenance and repair is second nature to them.

20 This awareness of maintenance requirements is not usualy the case in (so-called) developing countries; the emphasis tends to be on passing exams, on getting the theory correct, on getting the education done. This is achieved with very little practical experience, because the equipment is not generaly available.

21 As a result of this difficiency the concepts of maintainance are not recognised, the student moves into industry without the

awareness of the requirements of maintenance.

22 Sometimes, when a new plant is built there is no consideration of the equipment that may require special maintenance, based on the old plant's history, because as a (so-called) developing country, there was no old plant.

23 Without the awareness of the requirements of maintenance, when a new plant is built, there is this prevailing idea that, it's all new and should work just like a new automobile. However, automobiles have been developed and re-developed, over many years, to reduce the maintenance requirements to an absolute minimum and cannot, therefore, be used as a guide to the maintenance requirements for industrial equipment.

24 Unfortunately, immediately any plant is built and running it will start to wear out, Fortunately this is another opportunity to gain additional practical experience in maintenance.

25 The question for management is, can the equipment be maintained? Can the parts that will wear out be replaced? Can the equipment be kept working well? Does the level of maintenance keep the plant running well or better than new? If not, the investment of hard currency in the building of the plant is not protected, the investment in the building of the plant is at risk.

26 Maintenance protects the investment, maintenance is the insurance policy.

27 However, maintenance of equipment is the one thing that is lacking in the curriculum of the technical training schools.

28 This has been (and still is) due to lack of equipment to demonstrate maintenance and repair of equipment particularly in the field of industrial instrumentation and control systems.

29 The practical experience base, that a technician/repairman has, is a requirement to be able to properly maintain equipment and that base can only be drawn from practical experience previously gained.

30 The practical experience base can only be built with hands-on technical equipment. When the hardware is obtained, it will still be another 5 to 7 years before qualified repair and maintenance technicians are available, this is because the instructors also need that hand-on experience to be able to show illustrate and demonstrate the process of repair and maintenance to the students.

31 Sending instructors overseas to gain experience in maintenance of equipment is not that useful because the instructors still will not have the equipment with which to demonstrate and illustrate the practical expertise that they have gained.

32 Asking for additional experts in repair and maintenance of equipment to help VTC in their programms will not help without the equipment to show illustrate and demonstrate the techniques.

33 Without the equipment there can be no valid Industrial controls maintenance program, the lack of which can be seen directly in the conclusion sections of REF4 and REF5.

34 A plan for recovery from the existing condition in a series of basic steps is outlined in ANNEX 6.

35 Right now, VTC Damascus can be assisted significantly in its programme of industrial controls by having authorization to purchase or otherwise acquire the scrap instrument equipment that are available at various plants within the ministry. These parts can be used to demonstrate the use of the equipment even though they are incomplete.

36 The parts required are pressure gauges, temperature indicators, recorders, circuit boards etc. that are currently laying on shelves in and around the maintenance sections of the plants within the Ministry's authority.

37 These parts and equipment are very useful to the training program, for example;

38 Pressure indicators at the ADRA cement plant although broken, show what happens to pressure gauges and indicators when they are used beyond their limits, they can be used to show what how to check a pressure gauge to see if it has been overstressed (slight and almost undetectable ripples on the inside of the bourdon tube). Some of the internal gearing and calibration adjustment devices within the gauge can be used to explain the adjustment procedure with hands-on practice that students need.

39 Recorders have many internal parts, gears, shafts and sprockets that in the normal course of events need to be disassembled, cleaned and lubricated. Synchronous chart drive motors can be used as demonstration items. Circuit boards even with parts missing can be used to develope the skills of following circuit diagrams while looking at the hardware.

40 Broken or worn valves beyond repair are items that can be sectioned to show the internal construction and demonstrate the flow path of the liquid or gas and how the internal seals are constructed.

41 The added advantage is that this allows the maintenance section of the plant to tidy up its repair and maintenance area, to free valuable shelf space for items that can readily be repaired or that have been repaired and are waiting to be re-installed. There is also the possibility that parts might be manufactured at VTC to make the equipment work so that it can be returned to the plant.

Recommendations to VTC Damascus

42 The teaching of students in the theory and practice of equipment maintenance should be a priority. Proper maintenance extends the useful life of the equipment, protecting the investment which has already been made both in manpower and hard currency.

43 When studerts from VTC move into industry, the maintenance skills and the reason for the importance of their practice will spread within the industry, protecting its investment.

44 Nothing is more counter-productive to long term planning than equipment that has broken down or cannot be used due primarily to inadequate preventative maintenance. This type of breakdown implies lack of familiarity with the equipment. This lack of familiarity means the repair will be more difficult and take more time. The lack of preventative maintenance often means that spare parts have not been ordered, documentation is lost, the contact company who made the parts is unknown or more likely, the part is no longer available.

45 Unfortunately the preventative maintenance program in the machine shop is inadequate. Fortunately it is an opportunity to re-discover the purpose of preventative maintenance.

46 It is recommended that each piece of equipment be maintained by the students, supervised by the instructors, on a rotating basis dictated by this or a similar method:

a)By the "observe" method: Inspection of the equipment's labels, tags and signs attached to the equipment.

b)By finding, reading and understanding the instruction manuals.

c)By the "what if" method: If the molded plastic belt breaks it is already known that another one cannot be purchased or made locally and it will break - sometime before the equipment completely ceases to have any use.

47 There needs to be a maintenance department set up within VTC to show, illustrate and demonstrate procedures for planned maintenance. This department does not need to do the maintenance; its function should be to facilitate maintenance; ordering of consumables (oils etc.), overseeing the ordering of parts, acquisition of information (Instruction manuals etc.). planning of maintenance schedule and updating of maintenance records (see appropriate sections of REF7 for details).

48 Selection of the machine shop as starting point is highly recommended. A suitable section within the machine shop can be chosen as a trial area.

49 VTC Damascus has high temperature heat treatment furnaces used in the process of making hard tool steels. These furnaces are operational except for THERMAL FUSES. The fuses are used to protect the furnace from excess temperatures and are, from time to time, under normal operations, consumed. The fuses are usualy made of semi-rare metal combinations designed to melt at specific temperatures. These fuses are not available in Syria, nor does the local supplier intend, ever, to stock these fuses.

50 Since the furnace cannot be run at its designed temperature it must be run at a lower temperature and heat treatment of hard materials is therefore not possible. Softer materials are therefore produced, resulting in increased wear during production runs wherever the softer tool steel is used, in turn this causes increased down time and increased maintenance costs because tools now have to be replaced more frequently.

51 ANNEX 5 indicates the source and specification of the required parts.

52 A main air supply compressor for the Instrument Laboratory is required. Sizing of the compressor and tank is not known at this time. Purchase of main run copper pipe, tubing and fittings (to connect the tubing to the equipment) should include fittings that are compatible with existing fittings used in Syria at other plants that use pneumatic instruments.

53 A separate power supply system for the Instrument Laboratory will be required. At present the existing main power supply does not have a Ground and if, as anticipated, 4-20 Ma DC signals will be a standard in the future, than a good system Ground is a requirement. 4-20 Ma DC (or equivalent) signals require shielding especially in a building that has fluorescent lighting or any electrical motors. Consideration needs to be given at this time to the type of shielded wiring that will be used for all 4-20 Ma DC.

54 When the Fellowship individuals return from Italy it is recommended that they visit the plants that, hopefully, have been approved by the Ministry of Industry as a source of industrial equipment scrap. Arrangements must then be made to move the material to VTC for sorting and identification. This material and the techniques that they have learned in Italy can be used as a basic instrument maintenance training program. Additional benefit can be gained if the Fellowship Individuals, during the visit to the plants, can arrange some syllabus for in-plant training, again based on their experience in Italy.

Recommendations to BARBADA

55 There is insufficient broad based experience in hydraulic control systems maintenance and repair.

56 The large and expensive molding presses are used without allocating time for preventative maintenance or allocating time for technical training of additional maintenance personnel. The

investment in the purchase of the presses is being threatened.

57 Few people, at the factory, have the expertise to repair these large hydraulic presses and those that do, have insufficient time, due to their involvement in routine production management, to run preventative maintenance courses and pass on the skills that they have learned so far.

58 As the presses become older and wear increases, without preventative maintenance, repair down-time will increase. This will be happening at a time when a second product (the 2 door model) is being introduced, increasing production runs. Hence the existing technical experts, becoming more involved in production problems are less available to pass on their knowledge. A training program is required.

59 In this report in the section "Requirements for Experts" is the specification for a moulding press hydraulics expert.

Recommendations to ADRA CEMENT.

60 Acquire standard pressure gauges (0.25% accuracy minimum) that will cover the required ranges.

61 Resolve the contract problem with the manufacturer of the calibration benches and repair them or replace the benches with discrete test equipment with the same accuracy.

62 Replace the CO2 analyzers with analyzers of more recent technology (see REF1 and REF2).

63 Clean the dust out of the control panels, relay panels and the instruments, pressurize the cabinets with clean dust free air which does not contain volatile gases and keep the cabinets closed except for maintenance. Start this procedure of cleaning in a test area first.

Recommendations to IAMECO

64 Investigate the possibility of obtaining (see REF1 and REF2) a AC power testing device that will record frequency variations, voltage variations and spikes (sudden sharp increases that can cause damage to transistors) and identify the problem. Failing that solution, assume that the problem is with spikes and purchase a surge eliminator device (that will not allow any AC voltage over the normal to pass through its circuitry and into the equipment).

Recommendations to VIC HOMS

65 Used, damaged and scrap instrumentation from the local plants must be gathered, with appropriate circuit diagrams and instruction manuals to provide a minimum base of equipment before any hands-on instrument and controls maintenance expert is requested.

Recommendations to STEEL FACTORY (HAMA)

66 Especially in the melting shop there is an excessive amount of dust in the back of the control panels. The doors to the panels are left open and the room temperature is too high. Dirt and dust within the relay panels will cause excessive problems with the electrical relays. High temperature within the room that contains the motor speed control equipment will result in increased failures. The air conditioning system for these areas must be repaired, the room cleaned, and panel doors kept closed except for maintenance.

67 In the melting plant there needs to be more space provided for motor speed control systems repair, the skills of using oscilloscopes needs to improved and proper organization of test

equipment (layout) would increase the ability to repair motor speed control systems in plant.

(IV) OBSERVATIONS AT VTC DAMASCUS

68 VTC Damascus has 2 training systems, the "Accelerated" (9 months, (560 students/yr.) and the "Apprentice" (2 years, 560 students/yr.) a total 1120 students each year. There are options available for a second shift which will allow for the doubling of these capacities.

69 Practical training is available for the students of the Intermediate Institute, an average of 12 hours for each trainee per week, for about 100 per year. The Apprenticeship program (2nd year) has a 12 week in plant training program.

70 The accelerated students usualy work within the Ministry of Industry umbrella. VTC also assists the students obtain employment.

71 Most of the test equipment which is in use, is of commercial origin (3% to 4% accurate). It would be more helpful to have industrial quality (1% to 0.1% accurate). Most of the power supplies were built for vacuum tube operation, ranges +300Volts DC unregulated, purchased in 1976 and is not useful for the more modern equipment requiring +5 Volts DC, + and - 15 Volts DC and +24 Volts DC.

72 Although one of the main problems at VTC Damascus is the lack of proper tools, test and demonstration equipment in the Electronic/Electrical and Controls/Instrument workshop, it has a very well equipped Machine Shop and Heat Treatment department.

(V) SYNOPSIS OF PLANT VISITS

BARADA

73 The "BARADA" factory produces refrigerators for use in the Syrian domestic market. Although they are producing only one model there are plans for introducing a 2-door model in the future.

74 Most of the parts are made in Syria except the compressor, heat exchanger and thermal controls, which are imported from several other countries.

75 The factory is spacious and clean. It has a sheet metal forming section, a production spray painting section, a plastic molding section and an assembly/charging section. Due to it's additional tool and die maintenance plant, located nearby (not visited) and the close association with VTC Damascus heat treatment facility, the plant usualy enjoys comparatively good maintenance support.

ADRA CEMENT

76 There was insufficient time to visit the training center (which is not used) at this plant. The first visit was to the instrument maintenance section. There were 2 dead weight testers without the weights or the hydraulic pistons, the usual method of calibration of pressure gauges seems to be to see if the gauge under test indicates the same as another gauge of the same range (not a test gauge).

77 There are quite a number of broken electronic recorders and pressure gauges (with internal contacts) in one area of the room. Two standards calibration benches, which look extremely accurate, are not being used because they were broken on arrival (many years ago) and there is some contract disagreement with the

manufacturer.

78 There are continuing problems with the infra-red CO2 analyzers and these problems contribute to the stack pollution problems.

79 The main problem in maintenance of the equipment is dry, hard, fine and abrasive cement dust that has, over the years, invaded every piece of equipment including relay panels and the recorders in the control panels.

TAMECO (Pharmaceutical)

80 Tameco has developed a good instrument maintenance program. Since 1973 they involved their technical staff in the setting up of these maintenance programs. Tameco has developed a daily, weekly, monthly and yearly maintenance schedule over the years of operation and during any construction phase they do not accept equipment without instruction manuals or spare parts lists.

81 Spare parts are ordered on a regular basis and there is good stock control. Tameco has organized preventative maintenance shutdowns on a regular basis and it was during one of these shutdowns that this short visit took place.

82 They keep documentation of equipment failures and use this data to identify weak points in the equipment and take corrective action. Tameco is a local showpiece for the correct attitude and action of preventative maintenance.

83 It is worth noting that workers get a special allowance if the machines operate without breakdown so there is a tendency to minimize breakdown time and organize activities that will prevent breakdowns. Tameco has developed close co-operation between management and the technical staff. Also Tameco is a company which has a higher priority for available hard currency (to buy

spares and equipment) than the other companies visited.

84 Tameco have some problems with AC power; variation of frequency and sudden surges during major city-wide power blackouts. Typicaly the equipment manufacturer designed the equipment with a stable power supply in mind and regrets that this is not a problem that they have control over.

FERTILIZER PLANT (Nitrate and Water Treatment) Homs

85 Only 2 parts of the fertilizer plant were visited: the nitrate and the batch operated water treatment plant.

86 The nitrate plant control room seems clean and tidy. The plant uses old pneumatic technology. This plant also has production incentives. Where the old technology cannot be maintained new equipment has been installed, Foxboro (Canada) is one of the major suppliers of the newer pneumatic instrumentation and they use the services of that company to assist them in replacing the older equipment. They have a detailed maintenance program in operation and a yearly maintenance shutdown.

87 In the water treatment plant most of the system uses 4-20Ma signals, in conjunction with Fischer and Porter (USA) turbine meters and batch controllers. Rotameters normal, and magnetic follower style, are also used. A programmed sequence controller made by Texas Instruments (USA) which has been programmed to run that part of the plant is also in use.

VTC HOMS

88 VTC Homs has 6 training centers but the visit, due to time, was restricted to 2 of the training centers; Electricity and Metal Trades as UNIDO has been involved mainly in these two centers.

89 120 million Syrian pounds has been spent on this complex. The basic power supplies, benches and overhead lighting is complete but there is insufficient test, demonstration or calibration equipment to support an industrial controls at the present time.

SUGAR FACTORY (HOMS)

90 The yeast factory and the sugar beet processing plant (which was established in 1947) were visited. Most of the older instrumentation equipment is no longer maintainable and an expert is required to assist the engineering staff convert some of the old boilers from manual operation, which it has now become, to automatic operation.

91 In the yeast factory the instrumentation was more modern (4-20Ma) control loops with most of the controllers made by Fischer and Porter (USA - France), but in some instances the instruction manuals were missing. There is a problem of insufficient personnel with experience in industrial instrument maintenance.

92 Two years ago there was an attempt to create a training program outside the plant (within the petroleum industry) but this did not prove effective.

93 There were some instrumentation problems that were resolved as a direct result of the visit.

STEEL FACTORY (HAMA)

94 The rolling mill plant is older and of Polish origin and there is limited instrumentation, The relay and motor drive panels were installed in 1982 and are kept free from dust with regular scheduled maintenance periods.

(VI) REQUIREMENTS FOR EXPERTS

The requirements for Spark Erosion Expert (PRIORITY)

The Spark Erosion Expert will provide a training course for a maximum of 4 people, the course will consist of the following main items:

HELICAL PENETRATION: Where the end product has some form of helix and the erosion tool must move down and rotate at the same time in the process of removing material.

MATERIALS: Selection of appropriate materials for use as electrodes. Note that available materials at present are, copper, tungsten and graphite.

SIZING CALCULATIONS: Methods for calculating the dimensions of the electrode to produce a finite sized die, this includes electrodes for rough, smooth and fine finishes of the surface within the die.

PRACTICAL CONSIDERATIONS: Demonstrate the practical aspects of using this spark erosion equipment to optimize the speed of penetration with varying requirements for rough smooth and fine finishes.

EMBOSSING: Use of this spark erosion equipment to produce embossed products, such as spoon handles, medals and coinage.

TEXTBOOKS: Reference textbooks are generally not available locally and any textbooks, especially about the subject of heat treatment of tools and dies, (that can be left by the expert) would be welcomed.

TRAINING PROGRAM: Create and document a training program with the following major aspects:

a) Use of Spark Erosion Equipment.
b) How to control the spark generator.
c) Special care needed in aligning and adjusting.
d) Considerations of incorrect techniques, results of incorrect alignment.

TIMING: The overall time is expected to be 2 months. During the first 2 weeks the Expert will visit various local plants which use both the hardware and trained individuals from UTC. In addition the basic schedule of the course will be laid out. The actual course will last 5 weeks with the conclusion and evaluation taking place on the last week.

EQUIPMENT AVAILABLE: UTC has a very complete machine shop with lathes, grinders, presses and milling machines, but as this Spark Erosion equipment is considered special, a detailed description follows:

SPARK EROSION MACHINE.

SPARK MACHINE Model No EDM 500 (s/n M2078)
MFG BY: Elevum Electronic Equipment Ltd.
Gloucester Trading Estate
Hucclecote
Gloucester GL3 4AE, England. Tel(0452) 68356

PULSE GENERATOR Model No P25 (s/n G2078)
MFG BY: Elevum Electronic Equipment Ltd.
Gloucester Trading Estate
Hucclecote
Gloucester GL3 4AE, England. Tel(0452) 68356

X-Y POSITIONER "Travel Master" (s/n 5068 and 5076)
A.P. Warren Ltd.
263 High Street
Dorking,
Surrey, England. Tel(0306) 87331

ACCESSORIES

Power Pak Mod# 3R-8 (s/n 001-2), this is the speed control for the Rotary attachment.

Slide Mod# 3R-27.2

Holder Mod# 3R-29

Rotary Head & Motor Mod #R-1.6 (for which a spare belt is required).

Head Holder Mod# 3R ?

Ibe requirements for Molding Design Expert (2nd PRIORITY)

The Molding Design Expert will provide a training course for a maximum of 12 people, the course will consist of the following main items:

MOLDING DESIGN PRACTICE: To show and illustrate how to convert an existing final product design, in drawing form, or as an existing product requiring minor modifications, into a series of mechanical drawings that can be used by the machine shop to produce the major components (tool hardware) for the internal parts of the mould.

MOLDING DESIGN THEORY: Consideration of materials for the final product, clearance and release angles, shrinkage factors.

The type of plastic moldings that should be covered are Injection, Extrusion and Blow moldings, with special emphasis on the duplication of existing final products with minor modifications.

The plastic molding materials are typically;

Dow High Impact "Styron" Polystyrene in granular form.
Crystal Polystyrene.
Polyethylene.
Low Density Polyethylene in powder form.
PVC in granular form.
Phenolic molding Powder (Bakelite)

DIE CASTING DESIGN PRACTICE: As Molding.

DIE CASTING DESIGN THEORY: As Molding.

Die casting materials are copper, aluminum, aluminum alloys and zinc.

AVAILABLE MATERIAL: The Expert will be provided with a basic full size drafting machine and basic items (paper, rubbers etc.), all additional special items that may be required to complete the course must be brought by the expert as the existing local market is limited in quality and scope. VTC has a very complete machine shop with lathes, grinders, presses and milling machines.

REFERENCE MATERIAL: Any reference or textbooks that can be brought on the subject of moldings and diecasting design will be of great benefit.

TIMING: The overall time is expected to be 2 months. During the first 2 weeks the Expert will visit various local plants, such as Barada Company, which use both the hardware and trained individuals from VTC. It is expected that the basic dimensions of the molding presses can be acquired during this period. In addition the basic schedule of the course will be laid out. The actual course will last 5 weeks with the conclusion and evaluation taking place on the last week.

Requirements for Language Expert (Later)

Most of the teachers speak Arabic and English and they become motivated to learn the technical English which is needed for the subject that they teach. There is no need to arrange for a technical English expert. But there is a requirement for an expert to training language instructors in the best, latest method of teaching languages, such expert assistance has been provided in the past and has proved very beneficial.

TIMING 4 Months, the expert would move from one institute to another repeating the course as required.

Requirements for Molding Press Hydraulic Expert. (Later)

This is a brief and partial review of the requirements based on an unscheduled discussion with the maintenance engineers at Barada and is not part of VTD requirements.

The General industry for Metallic Industries (Barada Company), within the Ministry of Industries has a requirement for this type of training. Barada has a large number of molding presses which are used to produce the main components for refrigerators, interior panels, trays and interior doors. Their intention is to produce a larger capacity, 2 door model in the near future. Production problems exist from time to time with the molding presses which are of a complex electro-hydraulic nature, the presses have been used consistently for about 6 years and are beginning to show requirements for significant maintenance.

Although Barada has been careful with the technical documentation of the presses when they arrived, they still face the occasional major failure of the equipment and excess time is spent in the process of locating the problem, this due in part to the lack of time spent to date to gain sufficient expertise, due to production requirements.

As the machines age and the production requirements increase a critical point will soon be reached where there is insufficient expertise available at a time when failure rate can be expected to increase, due to age of the equipment and increased production.

Training in Electro-Hydraulics which relate to this local and export industry needs to be increased.

In General the main subjects that should be covered are:

Theory of hydraulics

Maintenance theory
Hydraulic practice
Use of test equipment
Maintenance practice
Repair of high pressure hydraulic equipment
High pressure safety considerations
Spare parts ordering
Stock maintenance

The only actual hardware that exists is located at the plant (Barada) and so all the practical work must be done at the plant within scheduled press shutdowns.

In General the Expert must have had hands-on experience in repair and maintenance of molding presses in general and familiar with the maintenance requirements for these presses in particular, this can be done by listing the manufacturer and model number of each press. These presses are of European design and therefore the drawing standards and symbols may differ from other parts of the world.

TIMING: 4 Months

ANNEX 1 - CONTACTS IN SYRIA

VTC DAMASCUS

Phd. Salim Neameh - General Director of VTD.

Mr. Monir Henawi - Director of Damascus VTC.

Mr Abdul Latif Zernaji - Director of Intermediate Institute Eng. and Metalic Industries.

Mr. Adib Amayri - Eng. - Technical Curriculum & Programs Department.

Mr. Walid Armanazi - Planning Department.

Ms. Salwa Al Solh - Vocational Schools Department.

Mr. Ghazi Jadah - Translation Section.

BARADA DAMASCUS (8-12-89)

Mr. Ibrahim Albitar - Engineering Section.

ADRA (CEMENT) DAMASCUS (8-19-89)

Mr. Suhil Saluum - Maintenance Department.

Mr. Hesham Hamed - Electrical Section

TAMECO DAMASCUS (8-20-89)

Mr. Mahmoud Sefo - Director, Labor

Mr. Ahmed Al Jazzer - Maintenance Department.

NITROGEN FERTILIZER HOMS (8-21-89)

Mr. Ragheb Edrees - Planning Department.

Mr. Nemer Assad - Operations Section.

VTC HOMS (8-22-89)

Mr. Ramez -

Mr Tarif Al Safi - Trades and Metal

HOMS SUGAR (8-23-89)

Mr. Fares Sharabz - Mechanical & Electrical Engineering

HAMA STEEL & PIPE (8-24-89)

Mr. Zouher Al Sahen - Director

Mr. Bashar Ady - Electrical Eng.

ANNEX 2 - PRACTICAL (WORKSHOP) EXPERIMENTS COMPLETED, VTC DAMAS.

LOGIC CIRCUITS: (7-8-89 to 7-25-89)

- DTL gates
- TTL gates, nand, nor, buffers.
- Tri-state.
- Mono /as /bi-stable multivibrators (discrete)
- Flip-flops, sr, d-latch, jk (integrated)
- Steered inputs (discrete)
- Frequency divider (integrated)
- Counters, up/down (integrated)
- BCD to Hexidecimal display (integrated)
- Latch/enable up/down counters (integrated)
- Shift registers (integrated)
- Comparators, adders, subtractors (integrated)
- D/A conversion

ELECTRIC MOTOR CONTROLS (7-26-89 to 8-1-89)

- Wattmeters - power in AC circuits
- DC Generator
  - Mechanical losses
  - Residual magnetism
  - Characteristics, separate excitation
  - Control, load characteristics, working point
  - Brush angle under load
  - Parallel excitation
  - Compound excitation
  - Series excitation
- DC Motors
  - Aborted due to lack of power supplies

SERVO CONTROL SYSTEMS (8-2-89 to 8-9-89)

- Parallel coil induction
- 3 phase servo transmitter and receivers
- Interconnection options for displacement and directional control

AC servo systems with mechanical feedback (positioning)
AC servo systems with electrical feedback (speed control)

ADDITIONAL ASPECTS COVERED (7-8-89 to 8-18-89)

Trouble-shooting DC power supplies
Use of oscilloscope in trouble-shooting digital circuits
Use of logic probes
Repair of oscilloscope pre-amplifier
Calibration of oscilloscope attenuator section
The need for testing and inspection in purchasing ICs
Calibration and maintenance of oscilloscope probes
Repair and maintenance of small fixed ratio gearboxes
Repair of control relay system
Maintenance of horizontal surface grinders

ANNEX 3 - INSTRUCTORS PRESENT DURING COURSE (8-7-89 to 9-8-89)

VTC DAMASCUS

Mamoun Sabbagh (*)

Nabeel Quli

Mou'dwi'ya Mazloun

Muhammad Joumaa Orabi

Salman Saqir

VTC HOMS

Ali Yaghi

VTC ALLEPO

Abdul Wahab Abideen

VTC DEAR EZZOUR

Khaleel Atalla

INTERMEDIATE INST. DAMASCUS

Youseph Shana'ah (*)

Ileen Ajram (listener only)

INTERMEDIATE INST. ALLEPO

Muhammad Ameer Jamal Eddeen

INTERMEDIATE INST. HOMS

Miss Reehan Al-Jandali

Miss Ibtisam Al-Najar

Note (*) Identifies Fellowship individuals

ANNEX 4 - RECOMMENDED SYLLABUS FOR FELLOWSHIPS, ITALY.

CALIBRATION AND REPAIR OF THE FOLLOWING:

1) PNEUMATIC INSTRUMENTS
   - Controllers (0.2-1.2 bar input/output)
   - Recorders (0.2-1.2 bar)
   - Square root extractors (0.2-1.2 bar)
   - Differential pressure transmitters (high and low range)
   - Pressure transmitters (using dead-weight tester)
   - Temperature transmitters (filled system)

2) ELECTRONIC INSTRUMENTS
   - Controllers (4-20Ma, PID with output limiters)
   - Recorders (4-20Ma, millivolt, resistance-temperature)
   - Square root extractors (4-20Ma)
   - Turbine flow-meters (primary and secondary)
   - Flow totalizing batch controllers (turbine input)
   - Rotameters with magnetic follower indicators
   - Temperature recorders (steel furnace, disposable probe)
   - Temperature controllers with SCR/Thyristor output
   - Temperature controllers, filled system-bulb, contact output
   - Fluid density transmitters (4-20Ma)
   - Magnetic flow meters, primary and secondary

3) OTHER
   - Small industrial relay controls
   - Hydraulic relay systems
   - DC/AC 3 phase motor speed control (SCR/Thyristor)
   - Inverters and AC voltage stabilizers for AC input
   - Under/over voltage protection systems for AC input
   - O2 and CO2 analyzers
   - Use of oscilloscope with external triggering
   - Mercury filled float type indicators and recorders
   - Use of microprocessor in control systems

ANNEX 5 - THERMAL FUSES (REQUIRED FOR) ELECTRIC FURNACES,
VTC - DAMAS.

The Furnaces are were made by:

Phoenix Furnaces LTD.
Rawson springs road,
Riverdale industrial estate,
Sheffield, S6 1PD, ENGLAND
TEL. (0742)346441

Furnaces are Model number:	Serial number:
MR7/17/	119/4/78
MR5(s)/17	117/4/78

Parts required are:

spare thermal fuse with sheath (ceramic)
spare thermocouple with sheath (ceramic)

NOTE:

(Presumably) one set for each type of furnace,
(presumably) temp. range/limit is specified by model number.

ANNEX 6 - A PLAN FOR RECOVERY

1.0 Investigate every possibility for acquiring the currency to purchase the demonstration equipment, calibration equipment and tools. Identify when this money will become available.

2.0 Re-identify, based on existing experience and previous recommendations, the types of equipment and tools required.

3.0 Based on REF1, REF2 and REF7 (where applicable) or other sources, identify the manufacturers of these types of equipment and tools.

3.1 Make a master list of the manufacturers names and equipment of interest.

4.0 Send letters to each manufacturer of each type of equipment, asking for the following:

> Specifications, operations manuals, instruction manuals, calibration manuals, pricing information, shipping information, delivery lead time and local representatives (if any).

5.0 In anticipation of the flood of replies, set up a filing system, headed by manufacturer's name, with a file for each piece of hardware sorted by model number, each file containing, in order, specifications, operations, instruction and calibration manuals. Pricing, lead time and local reps. should be filed in a seperate file sorted by manufacturers name as should original and future correspondence.

5.1 Estimate the time that most of the litrature is in hand and filed. Review and check off the list (3.1).

6.0 Based on the estimate (5.1) request an expert (for 2 month) to assist in the correct specification of the equipment to be purchased, review workshop layout, review timing for installation of support equipment (compressors, wiring, plumbing).

6.1 Working with the expert prepare detailed drawings of the workshop layout, plumbing, interconnect and power wiring diagrams.

7.0 Working with the expert generate the documentation to purchase the equipment, include in the purchase agreement the following:

> Complete payment will not be made until the equipment, and supporting Instruction manuals, wiring diagrams, circuit diagrams and spare parts lists are received.

8.0 Estimate the time that most of equipment is in hand. Review and check off the list of purchased items.

9.0 Based on the estimate (8.0) request an expert (for 6 months) to assist in the final receipt and inspection of the equipment and installation.

10.0 Working with the expert install and test the equipment, develop maintenance courses based on the hardware installed.

ANNEX 7 - BIBLIOGRAPHY, LIST OF REFERENCES

REF1 Instrument Society of America Yearbook 1989 - list of all USA manufacturers of industrial instrumentation. (in the hands of Eng. Mr. Adib Amayri - VTC Damascus).

REF2 Institute of Measurement and Control Yearbook 1989 - list of all UK manufacturers of industrial instrumentation. (in the hands of Eng. Mr. Adib Amayri - VTC Damascus).

REF3 Report on mission to Syrian Arab Republic, Ministry of Industry (Feb 16 - Mar 2 1986) Mr. Urs Etters, Industrial electronics consultant. ILO. regional office for Arab States

REF4 Maintenance and operation of instrument control systems in the FERTILIZER Plant - DP/SYR/86/009/11-09 - 24 May 1989 Mr. Utpal Ray, expert maint. & op. Inst. control sys.

REF5 Maintenance and operation of instrument control systems in the SUGAR Plant - DP/SYR/86/009/11-06 - 24 May 1989 Mr. Utpal Ray, expert maint, & op. Inst. control sys.

REF6 Expansion of the Vocational Training System -SYR/78/001 List of Equipment. Damascus Syria April 1982.

REF7 Service Management Principles and Practice. Published by Instrment Society of America (1978) by William H. Bleuel & Joseph D Patton Jr. (in the hands of Eng. Mr. Adib Amayri - VTC Damascus).