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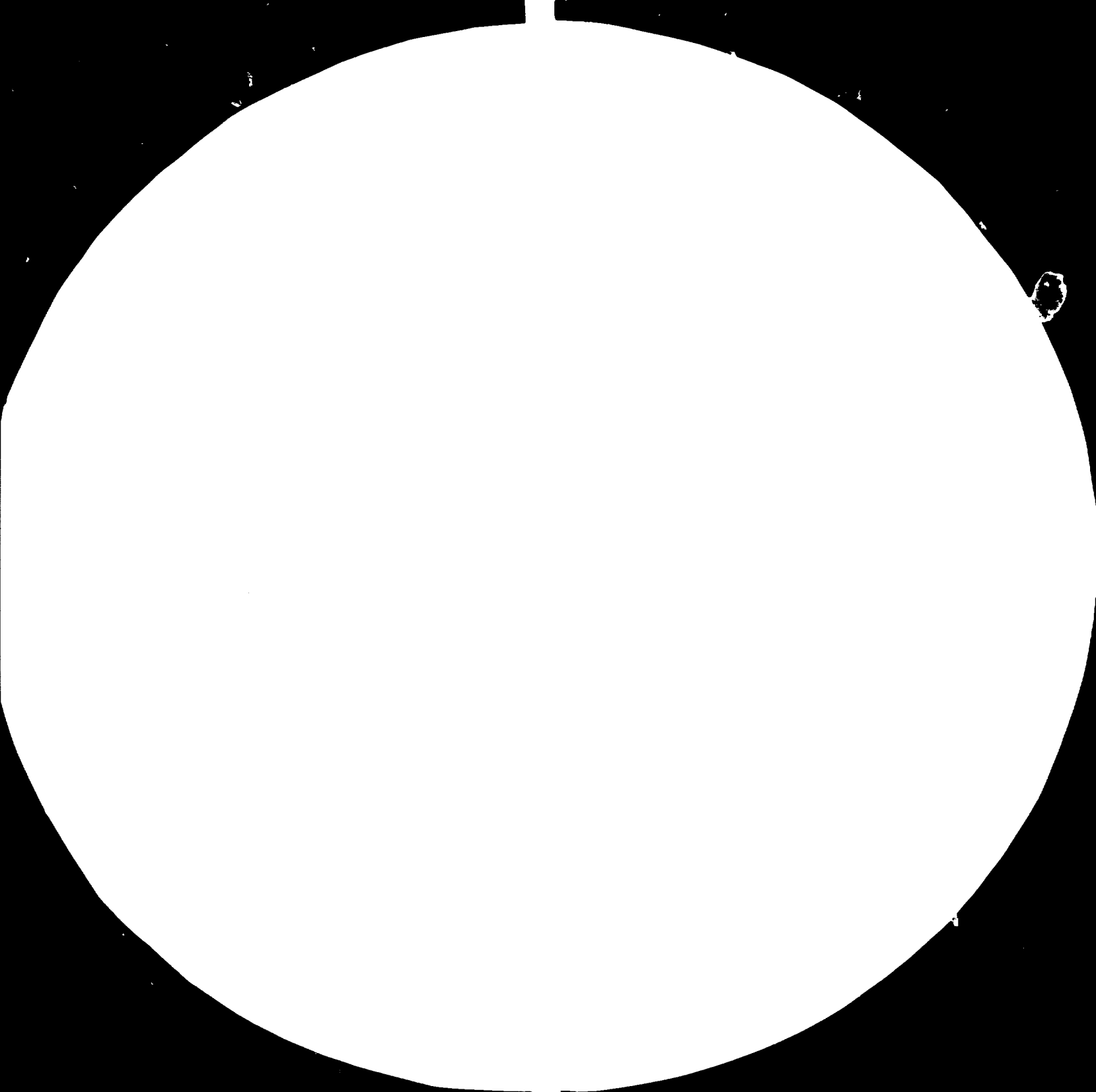
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STANDARD REFERENCE MATERIAL 1963-A
ANALYTICAL TEST CHART NO. 1010

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INDUSTRIAL TRAINING AND DEVELOPMENT CENTRE
(ITDC)

TECHNICAL

1983

TRAINING PROGRAMME IN
THE IDENTIFICATION AND PREVENTION OF FERROUS CASTING DEFECTS.

(October 24th to December 23rd 1983)

DF / TUR / 77 / 024 / 11-03 / B3 / 31.5.A

TECHNICAL REPORT

Prepared by

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Expert of the ITDC in collaboration with
The United Nations Industrial Development
Organisation acting as Executing Agency for
The United Nations Development Programme.

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This Report has not been officially cleared with the United Nations
Industrial Development Organisation, which does not therefore
necessarily share the views and opinions expressed.

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SUMMARY

- 1.1 The Turkish Government Industrial Training and Development Centre (ITDC) is presenting a series of training programmes in an effort to aid the technological development of the Turkish foundry industry. This is part of its general assistance to Turkish Industry, undertaken in cooperation with UNIDO.
- 1.2 During the course of previous programmes in this series, it was observed that Turkish casting quality was often below that attainable. In part this can be attributed to insufficient understanding of the nature of casting defects and of how they may be avoided.

ITDC therefore planned and organised a programme on the subject of "The Identification and Prevention of Ferrous Casting Defects". This programme was arranged for the period October 24th to December 23rd 1983.

The emphasis in the training was strongly practical, and was oriented to the particular needs and problems of the Turkish foundries participating.

- 1.3 A set of written training material was provided for use in the training seminars and for subsequent translation and use as a reference handbook in foundries. These notes were specially prepared for the programme, and include a set of illustrations to aid defect recognition.
- 1.4 In accordance with previous suggestions, the programme was organised on a regional basis. A number of foundries was visited in each of the five major industrial regions of Turkey, in order to provide shop floor assistance and training, and to identify particular problems. The series of visits was followed by a short seminar in each regional centre, to provide more formal training, and to deal in detail with the individual problems identified. The seminars were illustrated with slides, and a film on loan from the Institute of British Foundrymen.

This regional approach proved to be satisfactory for the subject, and was welcomed by many of the foundry managers interviewed.

- 1.5 The programme proved to be successful, both in the content of the training provided and in the practical emphasis.
- 1.6 It is recommended that the programme be repeated from time to time. It is also recommended that ITDC should provide additional programmes in future to cover a number of topics which were noted as being frequent sources of weakness and problems to Turkish foundries. Such topics would include core-making, runner systems for cast iron, and other related subjects.
- 1.7 Thanks are expressed to the staff of the ITDC, in particular the programme counterpart, to the management of many of the foundries visited, and to organisations which provided seminar facilities in the regional centres. The success of the programme was due to the efforts of these people and organisations, and to the interest and enthusiasm of the participants.

2. INTRODUCTION AND BACKGROUND

- 2.1 The Turkish foundry industry is growing in capacity and importance. In 1982 approximately 400 000 tons of ferrous castings were produced, an increase of nearly 20% on the figure for 1980.

In accordance with national economic policy the industry is endeavouring to develop direct export sales, and indirectly to assist in the exports of finished components and machinery.

- 2.2 The industry faces a number of problems, many of which are associated with limitations of technical knowledge and experience. Attention to these problems has been recommended by the industry itself, and by outside bodies such as the TSKB (Turkish Manufacturing Industry Development Bank).
- 2.3 The Turkish Government Industrial Training and Development Centre (ITDC) supported by UNIDO for the UNDP, is conducting a series of training programmes for the foundry industry, in an effort to assist in the technical development of the industry.

- 2.4 During the course of previous training programmes undertaken in Turkey as part of this ITDC effort, it has been noted that casting quality is often unsatisfactory. Castings may be sold and accepted even though they carry defects which could have been prevented. The level of internal rejects is often very high, so that operating costs and energy consumption are increased.

Turkish foundries frequently blame raw material difficulties for their quality problems. Some local materials do present disadvantages, but - as has been established during previous programmes - these can be overcome if proper attention is given to technical control. Training is needed, at all levels, to indicate and reinforce the knowledge of the practical steps that can be taken.

At the conclusion of previous missions it was suggested that a training programme in defect recognition and prevention would serve a useful purpose.

- 2.5 ITDC therefore decided to include a training programme on this subject in their schedule of assistance to the foundry industry in 1983. Emphasis was to be given to the practical aspects of the subject. Terms of Reference were prepared and issued as part of the official Job Description (attached as Appendix I).
- 2.6 Previous experience with ITDC programmes for the foundry industry has shown that particular value is obtained by visits to individual foundries so that problems can be discussed on site, and shop floor training can be reinforced by practical demonstration.

There is also a need for more formal seminar or classroom training, which must be integrated with the programme of visits. Attendance at such seminars is sometimes limited by the ability of small and medium sized companies to send key personnel away from the foundries for long periods.

- 2.7 It was therefore proposed that the maximum value would be obtained if the programme were to include a large number of foundry visits followed by one- or two- day seminars in each of several regional centres. In this way the best use could be made of the experts time, and it would be possible to direct the content of the seminars to meet identified local problems. It was also hoped to be able to attract more senior technical staff.

The programme was organised accordingly.

PROGRAMME

- 3.1 In order to make the most effective use of the time available, it was agreed that the training material would be best prepared in the expert's own country. A two week period was allocated to this activity.

A set of notes was prepared in a form suitable for use as seminar course notes, and also for use as a practical reference guide for foundry use.

The identification of defects requires the use of illustrations to aid in recognition. For this purpose a number of examples were selected from British and other foundries, and a set of slides and illustrations for the notes were prepared. Use was also made of illustrations from published material.

- 3.2 The original suggestion was that the notes should be translated into Turkish by ITDC during a gap of some weeks between preparing the material and travelling to Turkey to commence the programme. In the event the time available in the scheduled period did not permit this; the notes will have to be translated at a later date.

- 3.3 In view of time limitations, and the fact that previous ITDC training programmes had been carried out relatively recently, UNIDO agreed to waive the normal formal Briefing meetings at Vienna Headquarters.

Therefore as soon as the training notes had been completed - the first section having been airmailed to Turkey at the conclusion of the first week of preparation work - arrangements were made to travel to Ankara directly.

- 3.4 On arrival in Turkey introductory meetings were held with SIDPA at the UNDP offices, and with ITDC General Director and Project Coordinator and other senior staff.

Official Contacts are listed in Appendix II

- 3.5 The official Programme Counterpart was Celaletin Karabayer of the ITDC Metallurgical Department. The success of the programme must in large part be attributed to his efforts.

He, together with M.Ziya Tunç also of the Metallurgical Department, and Turker Aykal, the Chief of the Department, arranged the details of the programme schedule. At the same time the notes were transcribed and duplicated, together with the illustrations, for issue to the participants.

- 3.6 Visits were arranged to each of the three main types of foundry in Turkey:

Public Sector - Foundries as divisions of manufacturing organisations in the State owned sector

Private Sector - Large and medium sized foundries, either independent companies or divisions of larger Engineering groups. Visits were arranged to large, well equipped mechanised foundries, and to smaller less capital-intensive plants. Both iron foundries and steel foundries were included.

Small Scale - Privately owned small scale companies, employing little modern technology, and with relatively primitive facilities, producing simple iron castings for limited markets.

- 3.7 The visits were grouped into each of five main industrial regions of Turkey. (Izmir, Bursa, Kocaeli, Istanbul and Ankara) In each region a seminar was arranged for one or two days at the conclusion of the visits.

- 3.8 The details of the programme are set out below.

7.0 MISSION PROGRAMME

24th October to 5th November	Preparation of Seminar Notes and Training material. First section airmailed to ITDC.
7th November	Travel to Ankara
8th November	Meetings with SIDA and ITDC Project Coordinator . Arrange Mission programme.
9th November to 10th November	Supervise and edit transcription and reproduction of Seminar notes.
11th November	Checking of projectors and training material. Visit to Turk Traktor Fabrikasi, Ankara.
13th November	Travel to Izmir
14th November	Visit Pinar Döküm and BMC Foundry, Izmir
15th November	Visit Orsan Foundry, Izmir
16th November	Visit Şafak Döküm , Izmir
17th November	Visit Akçöküm ., Izmir
18th November	Seminar for participants from Izmir, at Pinar Döküm offices.
19th November	Travel to Bursa
21st November	Visit Burçelik Foundry, Bursa
22nd November	Visit Döktas Foundry, Orhangazi, Near Bursa
23rd November	Travel to Eskişehir. Meetings with Regional Officer, Ministry of Industry, and Secretary of Chamber of Industry to organise programme details. Visit Anadol Döküm etc.: small scale foundries in Eskişehir.
24th November	Visit E.L.M.S. Foundry, Eşçelik, and Deniz Döküm foundries, Eskişehir
25th November	Visit Entil and Eskişehir Şeker Fabrikası Foundries, Eskişehir
26th November	Further visit to Entil Foundry
28th November to 29th November	Presentation of Seminar for participants from Eskişehir, at Chamber of Industry Offices.
30th November	Travel to Istanbul
1st December	Visit Elmet Foundry
2nd December	Visit Dökyöl Foundry
5th December	Visit Boğazici Döküm Foundry
6th December	Visit Dökümay Foundry
7th December	Visit İral Çelik Foundry Second visit to Elmet Foundry
8th December	Visit Ferro Döküm Foundry
9th December	Presentation of Seminar for participants from Istanbul district, at Chamber of Industry
10th December	Travel to Ankara

3.2 (Continued)

11th December to 12th December	Commence drafting Final Report
12th December	Visit Döksen Foundry
13th December	Visit Erkunt Foundry and Yazar Pump Foundry
14th December	Presentation of Seminar for participants from Ankara district, at ITDC offices.
15th December	Visit İSKE Foundry Complete Final Report
16th December	Review meetings with SIDFA and ITDC
17th December	Travel to Vienna
19th December to 20th December	De-Briefing meetings at UNIDO Headquarters
21st December	Return to England.

Summary of Visits

- 2.1.1 Emphasis was placed on practical training and consultancy at factory level through the planned series of visits. The visits were all well received and the management of the foundries visited expressed their thanks and appreciation for the value of the training and practical assistance provided.
- 2.1.2 A total of 26 foundries was visited.

District	Public Sector	Private Sector	Small Scale	Total
Imzır	0	5	0	5
Bursa	0	2	0	2
Eskişehir	2	3	3	8
Istanbul	0	6	0	6
Ankara	1	4	0	5
Total	3	20	3	26

Summary Notes on the individual foundries visited are included as Appendix III

- 2.1.3 The course of the visits was varied to suit the requirements of individual foundries.

Usually there was an initial meeting at which the objectives of the ITDC programme were explained, and a general description of the foundry and its products and problems was provided.

Most of the time would then be spent on the shop floor, in company with technical managers, viewing casting defects, studying the production processes, and making - and whenever possible demonstrating - suggestions for improvements in order to overcome specific defect problems.

There would then be a final review meeting at which the recommendations would be summarised and explained to senior management.

On several occasions the foundries organised more or less formal meetings with larger groups of technical staff. Such meetings provided the opportunity for more general training as well as for question and answer sessions and detailed technical discussions.

The foundry would be invited to send participants to the regional seminar and to nominate subjects of particular interest for discussion at the seminar.

- 2.1.4 During some of the visits subjects and questions on foundry technology were raised which were outside the official subject of "Ferrous Casting Defects". The policy was adopted of giving advice and assistance, so far as was possible, on all topics raised, although concentrating primarily on those aspects relevant to casting quality and casting defects.

- 2.1.5 Several of the foundries visited had been visited previously during the course of one or other of three previous training programmes undertaken for ITDC:

S.C. Iron production	1980
Cupola Design & Operation	1982
Foundry Organisation	1983

Some of these foundries had made little progress in overcoming the problems previously identified. On the other hand many were taking positive steps to improve their application of technology, and to improve quality and productivity.

It is believed that the visits have shown several instances of the successful application of earlier advice, that provided clear and positive evidence of the value of the ITDC programme.

Seminar Training

- 1.1.1 The set of notes prepared before travelling to Turkey covers the field of Porous Casting Defects, with special emphasis on those defects and problems observed during earlier programmes in Turkey.

The notes consist of the following sections:

Introduction

Problems of Defect Identification and of nomenclature.

Organization of Inspection and Defect Analysis systems

Notes on individual defects, covering:

appearance

possibilities of confusion with similar defects

causes for the defects

cures and methods of prevention

Stress is placed on the practical steps to be taken to overcome the problems.

Appendices deal with :

an elementary identification key

process controls required to prevent defects

inspection and non-destructive testing techniques

illustrations of major defect types.

A copy of the notes is attached as a separate Appendix to this Report.

- 1.2.2 Although it was originally hoped that the notes could be translated into Turkish for use at the seminars, the time schedule adopted made it possible to include only the Turkish names for the defects.

The notes have been written in a brief form to assist translation, and it is suggested that ITDC should take an early opportunity to translate and reissue the main section, if not necessarily all the appendices.

In addition to their use for the seminars, and for possible future seminars on this or related topics that ITDC may plan in the future, the notes are designed to be used as a practical shop floor reference guide.

The coverage of the notes, and their relevance to Turkish conditions, will make them more valuable than any of the published material on this subject, in English or in Turkish.

At the time of translation ITDC would be able to include additional photographs of defects ; several of the foundries visited offered to provide examples for this purpose.

- 1.2.3 The notes, together with the slides prepared for the purpose, and a film on metal running loaned by The Institute of British Foundrymen, were used to present the training seminars at different regional centres. The emphasis in each seminar was varied in accordance with the problems found to be of particular importance to the participants during the course of the previous series of visits in each region.

In each case an informal presentation was used, and the maximum encouragement given to questions and comments from the participants. Despite the problems caused by the need to translate for some of those attending, a lively discussion was generated on all occasions.

Those attending included senior managers, technical staff, and also in some cases foremen and technicians. All appeared to benefit from the seminars and to have appreciated the training and the opportunity for the interchange of ideas and experience, an opportunity which is rare in Turkey where the Foundry Industry tends to be very close and over the than in many other countries.

4. The following Seminar presentations were made:

4.1.4.1 Izmir, November 16th, at Pinar Döküm offices.

There were 11 participants, from 4 foundries, including Pinar Döküm.

In response to local problems and priorities, the largest part of the time was devoted to dealing with Slag Inclusion and Blow Hole defects in considerable detail.

Thanks should be expressed to the Management of Pinar Döküm for providing the facility of the use of their meeting room.

4.1.4.2 At Döktaş Foundry, Orhangazi, November 22nd.

This presentation was made for the staff of Döktaş without participation from other foundries.

There were approximately 10 participants.

The presentation concentrated on dealing with problems raised by the participants, including the organisation of scrap reporting and inspection systems, and problems of Blow Hole and Core Damage defects.

4.1.4.3 Eskişehir, November 28th and 29th, at the Offices of the Chamber of Industry. The Chamber has two excellent meeting rooms, and is very suitable for the presentation of such seminars.

Thanks should be expressed to the General Secretary of the Chamber for providing the premises, issuing invitations, and providing hospitality.

There were 9 participants, from two foundries and - for some periods only - from the Ministry of Industry and the Chamber of Industries. A representative from a local moulding box manufacturing company attended one session.

The seminar covered the problems identified during the visits, and requested by the participants. Particular emphasis was given to a discussion of surface finish and surface defects, and to blow-holes and sand and slag inclusions. The seminar ended with a discussion on the organisation of Quality Control and Inspection.

4.2.4.4 Istanbul, December 9th, at the offices of the Istanbul Chamber of Commerce, Eminönü, Istanbul. The Chamber of Commerce facilities were very suitable for the small group seminar; a large conference room is also available for larger audiences.

There were eight participants from six foundries in the region, two of which were not included in the list of foundries visited.

According to the requests of the participants, the seminar dealt with the problems of slag inclusions, blow-holes originating from cores, necks, cracking, and swelling. A brief review was made of some major points arising in connection with other defects experienced by some of the foundries represented. The discussion was lively and interesting, with good participation from all of those attending.

Copies of the training notes were issued to the participants, and also to several of the engineers in the foundries visited who were unable to attend the seminar. Attendance at the seminar may have been affected by the large number of seminars of interest to foundries which were scheduled for the month of December in Istanbul.

5. CONCLUSIONS

5. 1. The training programme was successful and valuable to the Turkish foundry industry, those attending the seminars, and the companies visited.
5. 2. The programme adopted, emphasising practical training by a series of factory visits, followed by short seminars in regional centres, proved to be very suitable and satisfactory for the topic.
Many of the managers visited commented on the advantages, making it possible for staff to participate who could not be spared to attend a longer seminar.
5. 3. Nevertheless it should not be concluded that this approach would be suitable for every topic. Less practical and more theoretical subjects would require a larger proportion of formal training sessions.
5. 4. There is a wide variation in the standards of casting quality within the Turkish foundry industry. The best are fully comparable to international standards, whilst other foundries are satisfied with standards which are well below those attainable. The industry is growing rapidly, in technology and in capacity, and it is likely that the least efficient will be unable to survive developing national and international competition.

Problems inherent in the quality of Turkish raw material supplies can be overcome by proper attention to technical control.

The level of knowledge and ability of individual metallurgists and foundry technologists is as variable as the quality of the castings. In many cases technical responsibility is in the hands of engineers who have no suitable background training or experience. Many others have a reasonable theoretical appreciation of the principles, but insufficient experience in the practical application of control procedures and techniques. Such management cannot give the necessary guidance to supervisors and technicians who themselves lack a satisfactory background. On the other hand some foundries maintain a staff of experienced and able foundry technologists.

It is clear that the activities of the I.T.D.C. in programmes such as this serve a continuing and valuable purpose.

5. 5. A number of weaknesses and problems responsible for casting defects were common to many of the foundries visited. These included in particular:
 - 5.5.1 Insufficient knowledge of core making methods, and of the details of the design and use of cores in castings.
 - 5.5.2 Insufficient appreciation of the principles and importance of proper running and gating systems in preventing defects such as inclusions in castings.
 - 5.5.3 Insufficient attention to moulding methods, and to practical shop-floor sand control, resulting in unnecessary defects due to poor mould quality.
 - 5.5.4 Insufficient use being made of casting inspection data in guiding process control to the prevention of defects, and insufficient realisation of the importance of organising production in such a way as to obtain reliable and comprehensive inspection data as soon as possible after production.
5. 6. The success of the programme must be attributed in large part to the constructive reception and assistance provided by the management of the foundries visited, the facilities and help given by local organisations such as Chambers of Industry, and especially to the organisation and hard work of the Mission counterpart Celaletin Karabayar with colleagues from the ITDC metallurgical department.

6. RECOMMENDATIONS

- 6.1 ITDC should arrange for the translation of the notes into Turkish, for issue to the seminar participants, for use in future seminars, and for use as a practical handbook in foundries.
- If possible more illustrations should be included, by adding photographs of defective castings loaned by Turkish foundries.
- ITDC could take the opportunity of attempting to standardise the Turkish nomenclature for casting defects and technical terms. At present different foundries use a confusing variety of terminology.
- 6.2 The training programme should be repeated at regular intervals, preferably with the same emphasis on shop floor practical assistance from experienced foundrymen.
- 6.3 Consideration should be given to the preparation of simplified versions of the programme. Such versions would be designed to be suitable for :
- Groups of foremen, technicians, patternmakers and senior skilled operators without formal technical training.
 - Representatives from small-scale industries, who are in need of assistance in product quality improvement, but lack resources of equipment and technical training.
- 6.4 For other programmes with a similar practical emphasis a similar organisation should be adopted, with short seminars in regional centres preceded by a series of factory visits for practical training.
- 6.5 Whenever possible time should be allowed for the translation of seminar training material into Turkish before the start of the programmes.
- 6.6 ITDC should continue the series of training programmes provided for the foundry industry, to reinforce and continue the valuable work already done.
- In particular there appears to be a need for training programmes in the following subjects, which should be included in ITDC planning for the future:
- 6.6.1 Practical Coremaking, including an explanation of alternative processes and practical aspects of the design and use of cores in different types of casting.
A suggested programme outline is included as Appendix V.
Shortcomings in coremaking were responsible for a high proportion of the quality problems observed during the foundry visits.
- 6.6.2 The design of running, gating, and feeding systems for cast iron castings (grey iron, Spheroidal Graphite iron, malleable and alloy iron). Such a programme would complement the existing ITDC programme on the gating and feeding of steel castings, which has been repeated. A programme on this subject appears to be necessary, and was specifically requested during the foundry visits.
- 6.6.3 Moulding Technology, to include practical training in the control of moulding sand and sand systems to suit different requirements, and in relation to the problems caused by Turkish sand and clay characteristics. The programme would also include practical instruction on the use of moulding machines in order to improve mould quality and production efficiency.
- 6.6.4 Maintenance of Foundry plant and equipment.
- 6.6.5 Management systems for Foundries, in particular Costing systems and Quality Reporting and Control systems.

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4.7 In addition to new programmes on the above topics, consideration should be given to repeating programmes or aspects of programmes previously presented by ITSC. For example numerous questions were raised about details of the production and control of S.C.Iron, and about the design and control of crucibles, both of which were dealt with in previous programmes.

ITSC has a policy of repeating valuable and useful programmes, and consideration should be given to adding these subjects to those regularly presented.

APPENDIX 1



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNIDO

PROJECT IN THE REPUBLIC OF TURKEY

JOB DESCRIPTION

DP/TUR/77/024/11-03/83/31.5.A

Post title Expert in Ferrous Casting Defects

Duration 2 months

Date required As soon as possible

City station ITDC in Ankara, Istanbul, Bursa, Izmir with possible travel within the country

Purpose of project To upgrade the skills and capabilities of engineers employed in foundries and to train them on the subject of ferrous casting defects thus minimize rejects, increase quality and productivity.

Duties The expert with his counterpart(s) from ITDC will conduct a training programme to improve the casting defects knowledge of engineers employed in foundries and give necessary information about the casting defects encountered in foundries. More specifically, the expert will be expected to:

1. Review the prevailing working methods of foundries related to identification, verification, prevention and cure of ferrous casting defects. This study will be based on the plant visits within the country. Meanwhile trouble-shooting sessions will be conducted.
2. Prepare a training programme to cover general aspects of ferrous casting defects, namely:
 - Identification of defects
 - Description of defects
 - Causes of defects
 - Prevention of defects
 - Cure of defects
 - Equipments for detecting the defects

3. The programme schedule might be detailed as follows:

Preparation of seminar notes in English, in England	2 weeks
Allow 1 week for postage, 3 weeks for translation and copying, and preparing photographs. Action by SECEM not involving expert.	4 weeks
1 week travel, briefing, final arrangements, checking notes, etc.	1 week
1/2 week visits (1 week in each of four regions, e.g., Ankara, Istanbul, Bursa, Izmir)	4 weeks
1 week final report, debriefing, travel	1 week
Total	<u>8 weeks</u>

4. The expert should supply back up materials for the mission in the form of:

- articles and lecture notes,
- films, slides and books, which may be purchased by ITDC, if the expert can make these available.

5. Supply the ITDC with necessary training aids; such as books, written articles, films, lecture notes, diagrams, etc.

6. Document the training materials in booklet form. The expert will also be expected to prepare a final report, sending out the findings of his mission and his recommendations to the Government on further action which might be taken.

Qualification: Expert, preferably a foundry engineer should have extensive experience on the subject and also training experience.

Language: English

Background Information: It has been observed that in many Turkish foundries, the quality consciousness should be improved. Reject rates in most of the foundries are very high and are above the common level in industrialized countries. The foundries suffer from a relatively high reject rate. The only reduction of the reject rate, that means a better control of the production, could reduce substantially production and operating costs.

The importance of the subject has been emphasized by also the experts which have worked for the Industrial Development Bank of Turkey. They recommended that programmes have to be developed to find out the eliminate reasons for high reject rates.

It has been suggested that an ITDC training course could help to meet this training need. This programme is organized after the requests from public and many private sector foundries and it is expected that about 30 engineers will participate.

The Industrial Training and Development Centre (ITDC) is a joint project of Turkish Government and United Nations which provides training and consultancy services to the industrial sector. Its objectives is to upgrade the skills and capabilities of professionals employed in industry thereby contributing to the national economy.

APPENDIX II

OFFICIAL CONTACTS

IITM Vienna	Mr. J.P.Dee Ms. L.Taylor Ms. M.Sippl	Substantive Officer Project Personnel Recruitment Project Personnel Administration
IITM/IMM Ankara	Mr. G.Narasimhan Mr.H.Rosnitchek	SIDFA JPO
ITDC Ankara	Mr Yilmaz Ayman Mr. Teoman Tumer Mr. Murat Bursa	Director and Project Coordinator Assistant Technical Director Assistant Project Coordinator (took up another appointment during the programme)
	Mr. Turker Aykal Mr. Celaletin Karabayer Mr. M.Ziya Tunç Mr. Ali Han Ms. Serpil Çubuk	Chief of Metallurgical Department Programme Counterpart Metallurgical Department Metallurgical Department Assistant Project Coordinator
Ministry of Industry, Eskisehir	Mr. Mehmet Egitmenoglu Mr. Mahmut Yilman	Regional Officer Engineer
Chamber of Industry Eskisehir	Mr. Yusuf Köse	General Secretary.

APPENDIX III

Summary of main points arising during the Foundry Visit Programme

<u>Foundry</u>	<u>Region</u>	<u>Page</u>
Perrodöküm	Izmir	18
Anadolü Döküm (and other small-scale foundries)	Eskişehir	19
MKE Foundry	Izmir	20
Boğaziçi Döküm	Gebze, Nr. Istanbul	21
Arçelik	Bursa	22
Boniz Döküm	Eskişehir	23
Dökmen	Ankara	24
Döktaş	Orhangazi, nr. Bursa	25
Dökümay	Istanbul	26
Dökyöl	Istanbul	27
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Akdeniz Sanayi A.S. Finarbasi, Izmir

November 17th 1983

Süleyman Atik Production Director

A well established family business, producing SG iron castings for the automotive and tractor industries. The plant is not modern, but well designed and the application of SG iron technology is good - especially the production of sound castings with a minimum of risers. Many of the castings are machined before sale.

A new extension has been approved, and equipment is being delivered. This will consist of a modern automatic high pressure moulding machine, high efficiency automatically controlled sand plant, and induction melting and short coil holding furnaces - all from West Germany. It is planned to use this facility for grey iron automotive casting production, which will place them in the second or third position in Turkey in this market from 1985.

One problem is likely to be technical management - at present the Production Director appeared to have little assistance, and it is not possible for the present high standards to be maintained in the existing and the new plant unless he is able to delegate to competent staff.

Casting Defects Discussed :

Sand Inclusions
Scabbing
Surface Roughness

Other topics discussed:

Operation of the new plant
Control of sand properties , the selection of sand testing equipment, and the characteristics of the high intensity mixers ordered with the new plant.
The use and significance of the shatter test
Selection of coremaking processes - this aspect of the extension has yet to receive full attention, and may be affected by the limitations of local materials and technology.

Anadoluköyü, and other small-scale foundries in Eskişehir. November 23rd 1965

In Eskişehir, as in other Turkish industrial areas, there is a large number of very small foundries and foundry workshops, employing from two to twenty people, using rudimentary technology and equipment to produce simple castings for stove parts and miscellaneous machinery spares.

The Ministry of Industry is anxious to assist these companies to develop, and a visit was arranged, through the Secretary of the local Foundry Association, to two or three typical small foundries in a workshop area of Eskişehir.

Scrap flask moulding on the floor is the principal method of production, the complete floor area - and even out onto the street - being covered with moulds before melting is commenced. The sand used is from Terkos, which has a better grain shape and mouldability than the Şile sand used by larger foundries; however it is not sufficiently refractory for other than thin section castings. Sand preparation is by hand, or in simple home made mixers; sand screening is not sufficiently conscientious.

Cores are generally not used. Runner systems are crude, but efficient in the sense of maximising casting yield even though slag inclusion defects are frequent. Simple small cupola furnaces are used, melting pig iron and scrap with gas works coke. Casting cleaning is by wire brush.

The surface quality produced was adequate for the application, as stoves with obvious casting defects are acceptable in the market. Considerable craft skill and ingenuity is used to make the most economical use of raw materials. Many quality improvements could be made, but often these would increase nett production cost at no benefit to the product marketability - the incentive to improve will arise as competition forces rationalisation and technically better products provide competition in the market.

Working conditions were not good, and this method of production will not survive a significant improvement in the expectations and standard of living of the country.

Casting Defects discussed:

Misrun, due to poor melting practice and coke quality
 Sand inclusions, due to careless moulding and poor sand preparation
 Slag inclusions, due to cold metal and crude runner systems
 Breakage, due to poor casting design and lack of metallurgical control.

Other Topics discussed:

Improved cupola operating procedures
 Deleterious effects of lead additions
 Design of runner systems
 Use of scrap metal as well as pig iron in charges
 Economical and practical use of moulding machines for this type of production.

Dr. Fatih Başdoğan	Foundry Manager
Teoman Altınok	Shift Technical Manager
Muhsin Tufeci	Shift Technical Manager
Kenan	Quality Control Manager

The foundry is part of the Izmir works of BMC, producing British Leyland commercial vehicles for the Turkish Market. Engine blocks, cylinder heads, brake drums and other grey and SG iron castings are produced.

The layout and methods are based on British Leyland experience in England; some of the problems result from the differences in materials and conditions in Turkey. This is especially true in the core-making department.

Casting Defects discussed:

Blowholes (core venting problems), finning , and penetration on water cooled automobile cylinder head castings.
Roughness (external surfaces of brake drums), Crushing and moulding defects.

Other topics discussed:

S.G.Iron treatment methods, and the possible elimination of double metal handling and transfer with resultant savings in metal temperature, energy costs, and production potential - since production is limited by melting capacity and electricity rationing.

S.G.Iron quality control and metallographic inspection. Metallography techniques need to be improved to permit a sufficient number of examinations per day.

Casting design problems , including service failures experienced in cylinder head castings used in engines which are often abused by overloading.

Sand preparation problems, associated with the characteristics of Turkish sands and bentonite.

Coreblowing methods for automotive castings.

Pattern plate design and moulding machine operation to improve mould compaction.

Manzili Kuru . Manzili Kuru Nevkii, Çayirova, U.S.S.R. 5th December 1983

K. Umut Bilgen Managing Director
Oktaç Kora Plant Manager

A small steel foundry, producing about 3 - 4 tons per day, with a work force of 115 . Hand and machine moulding are used, with little mechanisation and consequent heavy use of labour. Coremaking is limited to oil sand, not well controlled, and a little furane. Inductotherm tri-line and medium frequency induction furnaces are controlled by a simple laboratory. The lay-out of the finishing section is logical, and better than that in most Turkish steel foundries.

The plant manager is newly appointed, with no previous foundry experience, and there are no qualified technical engineers, other than an electrical engineer who was supervising the furnaces. In consequence all technical matters are inevitably left to foremen and operators: there is a serious lack of applied technology and experience, and it was necessary to give background explanations for many elementary points.

Casting Defects Discussed:

- Surface Roughness, linked to poor sand control (there is no sand laboratory)
- Slag inclusions, linked to runner systems made by hand with no technical control.
- Shrinkage defects, and problems due to wrongly applied internal chills
- Run-out and sand inclusions
- Core defects

Other Topics discussed:

- Better calculation of feeder systems
- Inevitability of attempting to produce grey iron and steel castings in the same foundry.
- Need to improve productivity by better organisation and simple mechanical aids.
- Need to standardise on methods and eliminate unsupervised hand-cut runners
- Advantages of better control of coremaking, and explanation of the CO₂ process.
- Organisation of inspection and reporting systems suitable for small foundries
- Need to design patterns to permit better core location and venting.

Burçelik A.S. Organize Sanayi Bölgesi, Bursa.

21st November 1983

Ozer Doğan Soysal	General Manager
Faruk Ozer	Technical Manager
Süleyman Erterin	Metallurgist

A medium sized steel foundry, with a policy of developing expertise in the production of special purpose, premium quality, low alloy steels in order to avoid the problems due to over capacity in the standard qualities of steel castings. A continuing programme of experiments and trials is giving useful results. The foundry is 15 years old and is not well laid out or organised. Most moulding is by hand although there is a machine section, and core assembly methods are used for cast chain (for marine applications). CO₂ , Furane, and hot box cores are used.

A separate factory machines some of the castings, and also produces a range of foundry and other machinery for sale - sand mills, sand transporters, shot blast machines, coal crushers, etc., to Burçelik design.

Casting Defects Discussed :

Sand Inclusions - related to poor sand control and works organisation
Hot Tears and Shrinkage cracks, related to casting design
Slag Inclusions, related to running systems and pouring methods

Other Topics discussed:

Corin and running methods for complex louvre castings , and railway engine castings
Desulphurisation, De Phosphorisation, and Argon degassing on a small scale for
the production of premium quality steels for high specifications
Heat Treatment, and the importance of uniform charge heating

Deniz Döküm Fab. A.S.

Eskisehir

24th November 1968.

Gültekin Güney General Manager

A new company, privately owned and managed, producing grey iron castings for weights for elevators, tractor wheel weights, press bodies, and other grey iron castings. Capital expenditure has been minimised by the use of a number of pieces of ingenious home made equipment - cupola, sand mill, core sand mixer, sand transporter, sand aerator, etc.

The cupola furnace is complete with simple air blast volume measuring equipment, as advised in many Turkish foundries but seen applied only in this one case. By careful control of combustion conditions they are able to melt a charge consisting entirely of swarf packed into cans, giving a great saving over alternative raw materials, and a quality adequate for the requirement of counterweight castings. Melting loss is not more than 10%.

Castings Defects discussed :

Sand and Slag inclusions

Other Topics discussed:

Alternatives available for coremaking processes

Future development plans

Use of double tuyere systems for coke savings

The economics of mould coating and skin drying instead of coal dust additions.

Öksan Çelik San. A.Ş., Istanbul Yolu 12 Km.

Ankara

12th December 1983

Bilvan Özman Foundry Manager

A steel foundry, producing up to 8000 tons per year with a workforce of 110 people. Production includes carbon steel, low alloy steel, and manganese steel castings, from very small sizes up to about 1 ton in weight. Castings are supplied to the construction equipment machinery market and general engineering markets, mostly in the Ankara region.

The foundry dates from 1968, and there has been little investment in foundry plant since that time. The facilities are therefore not modern, and not in good repair. However there has been investment in machine tools, and in an induction hardening machine, so that a large part of the production, especially of gears and shafts, is supplied in the fully machined and heat treated condition.

There is insufficient quality control equipment, and too high a proportion of the work is made by hand. Coremaking is by the furane process exclusively. Nevertheless castings are made to high standards, with radiographic soundness criteria having to be met on several pieces.

Castings Defects Discussed:

Hot Cracking, including cracking of Manganese steel after cutting off feeders.

Shrinkage

Slag Inclusions

Gas blow holes near feeder connections

Other topics discussed :

Use of chromite sand to accelerate cooling

Feeding and running systems for sinter palette castings and for roll bearings

Use of Furnace moulding instead of hand moulding

Means of engineering air quenching of boggy hearth furnace charges

Doktaş A.S.

Orhangazi, Near Bursa

22nd November 1983

Yalali Gunay
Ilhan Bataci
Levent HatirliTechnical Director
Production Manager
Projects Manager

A modern mechanised iron foundry, reputedly the best equipped and most technological advanced Turkish foundry. 19 000 tons of castings per year are produced for the automotive and tractor industries - Doktaş is part of the Koç group which produces Ford and Fiat vehicles. Castings are exported to western Europe. Quality is good, and the staff are technically competent and well-informed. Nevertheless productivity and plant utilisation, and also casting scrap, are below European standards. A new moulding line is being installed during 1984.

Casting defects are a serious problem; records and data are comprehensive, showing a gradual improvement year by year (currently 11% total scrap). Many of the quality and production problems arise in the coremaking area.

Full use was made of the visit: a group discussion on individually difficult casting defects was arranged with senior technical managers in the morning. This was followed by a plant visit, and a presentation of some general principles to a wider management group in the afternoon. The visit concluded with a discussion of optimum methods of organising casting inspection - improvements could be made by obtaining, and using, inspection data more promptly.

Casting Defects Discussed:

Gas Blowholes (Core production, venting, and print sealing)
Crushing and Mould damage, often due to core distortion
Pellets and short pouring, due to poor pouring control
Sand inclusions due to drying out of part completed moulds during plant stoppages.

Other Topics discussed:

Operation of mechanised pouring systems, pouring bushes and operator visibility.
Methods of maximising mould compaction with multi squeeze head machines
Core sand composition, and iron oxide additions
Core coating and drying, and thermal behaviour of cores
Core deterioration in storage
Production of complex cylinder head castings
SG iron handling and treatment to avoid double ladling, and excess energy consumption
Effects of Phosphorus and Sulphur on metal penetration and inoculation response

Notes A.I.I. International Inter. 31

6th December 1985

Neal Ogilvie Assistant Production Manager
 Neal Ogilvie General Manager

A family owned company, producing cast vitreous enamelled baths for the Turkish market - now investigating the export potential. The plant is not new, and although reasonably efficient is in need of improved technical control to compete internationally. Management is investigating various processes, such as the Vacuum process, but investment potential is limited, and must be phased to secure acceptable cash flow.

Casting Defects Discussed:

Cracking

Cracks and other hard defects

Inclusions: slag and sand through poor supervision of pouring and melting

Blow Holes and Cold Shut, due to lack of sand control and of pouring temperature control.

Other Topics Discussed

Advantages and problems of the Vacuum moulding process

Improved tapping systems for cupola furnace thermal efficiency

Need to operate consistent sand control

Need for care in handling to avoid damage to fragile castings

Possible design changes to minimise the likelihood of defects.

Elmad Metal-Metal Sanayi A.S. Silahtaraga, Alibeyli 101, Üzeri, Eyüp,
Istanbul

December 1st and 7th 1983

Walter Tütüoğlu Ass General Manager
 Mehmet S. İzar Ass Technical General Manager
 Metin Başaran Director of Research

One of the first modern foundries in Turkey, closed following labour problems in 1979, and reopened in 1982 with new management and under new ownership. There are two separate foundries, for iron and steel castings. Production is very varied:

5000 - 7000	tons, yr of	177 & 287 Chrome steel grinding balls, for the Turkish and Iraqi market
2000	tons, yr of	General medium and heavy steel castings
3000 - 5000	tons, yr of	Cast Iron, including cylinder blocks and heads, gearboxes, and SG iron insulator cap bodies and tractor castings.

Because of this variation, and the limited experience of the new management, there are many technical problems and scrap is high. The plant and equipment is not fully utilised.

Casting Defects Discussed :

Surface roughness (Poor sand control)
 Irregular break-off fracture (Poor pattern maintenance and poor moulding)
 Cracking on grinding balls (heat treatment and grinding problems)
 Blow holes in cylinder heads (core making and venting practice)
 Breakage of gearbox castings during customer processing

Other Topics Discussed:

Organisation of Inspection systems
 Running and gating of cylinder heads
 Contraction allowance and feeding methods for large Manganese steel cover castings
 Casting production techniques for heavy SG Iron wheel castings
 Moulding machine operation for maximum sand compaction
 Metal pouring temperature measurement and control
 Core sand specifications and resin contents
 Problems with delayed setting time of furnace sand in cold weather
 Core venting techniques for hot box coremaking
 Choice of modern coremaking processes - SO₂ or Amine
 Pattern Design problems
 Comparison of productivity, energy consumption, and quality standards
 between Western European and Turkish foundries
 Investment priorities.

At Elmad management request a second visit was arranged, for a round-table discussion and question and answer session on a number of specific technical points and general criticisms. This meeting was attended by about 12 to 15 metallurgists, technologists, and managers.

November 24th 1963

İrfan Fidan
Sedik Adanır
Muzaffer Kir

Foundry Manager
Steel Castings Supervisor
Metallurgist

The foundry produces about 1000 tons of grey iron, 750 tons of steel, and a little non-ferrous metal, annually. However the plant has substantially greater capacity than this ; productivity was low and scrap was estimated to be about 20%. There is a mechanised moulding plant, a large hand moulding area, cupolas, induction furnaces, a good pattern shop, and a core making area (oil sand and furane) . Technical control is not good, especially in the coremaking area. Most steel castings are weld repaired.

Casting Defects Discussed :

Hot cracking and tearing of steel castings - shrinkage defects
Blow holes, attributed to poor control of core curing and venting
Rough castings and crushed moulds , mostly due to poor sand preparation and inadequate control of moulding techniques.
Burnt on sand, due to variations of methods of mould coating.

Other Topics discussed:

Advantages of the CO₂ core making process
Means of ventilation and sealing of core prints
Need for temperature control in the core stove
Feeding techniques for steel wheel castings - importance of feeding distance as well as of relative modulus.
Mould coatings for bronze castings
Sand milling efficiency and time cycle
Need to consider important casting faces when planning methods.

25th 26th November 1985

Datil S.A.

Zeytinçözü
Salih Vatansöver
Yakup
Halilhan Erten

Eskişehir

Director
Foundry Manager
Works Engineer
Metallurgist

Datil produces about 500 tons per month of grey iron castings in various categories: ingot moulds, metal rolls, die blocks and other heavy castings, and machine moulded castings such as flywheels, wheel weights and general engineering pieces.

Cupola melting is used, despite the variety of metal specifications required. There are two machine moulding lines, and a hand moulding section. Cores are blown, or hand made, in CO₂, coated with silica flour wash.

At the present time surface roughness and adherent sand problems are a major difficulty for the company as shotblasting is a bottleneck and casting sales are being restricted.

Casting Defects discussed:

Surface roughness and adherent sand
Scabs and Ret-tails
Shrinkage
Hot tearing in ingot moulds

Other topics discussed:

Corebox construction for flywheel-fan castings
Improved sand testing methods and records
Design of the Shatter Test apparatus
Need to measure and control volatile material content in moulding sand
Mould connection on deep machine moulded castings
Estimates for new sand addition requirements
Shot blasting machine efficiency
Marketing and development policy
Metal pouring temperature control in relation to casting section

Erhan Foundation, Industrial Yolu, Ankara

15th December 1963

Erhan Foundation	General Director
Metallurgist	Metallurgist
"	"
"	"
"	"
"	"

Erhan is a well established private sector foundry, supplying the tractor and commercial vehicle markets. Most of the castings are supplied fully finished. About one third of the production is in S.G. iron.

Erhan is on a mechanised system, which is soon to be augmented by two new automatic high pressure moulding lines (of German and Danish manufacture) which are now nearing the final stages of installation.

Erhan includes a variety of processes and equipment, including a new hot-chamber die casting machine for the production of amine-cold box cores - believed to be the first application of this process in Turkey. The output from this machine is still experimental, and numerous sand and coreblowing problems, as well as working condition problems, remain to be overcome.

Testing Defects Discussed :

- Flow Holes in Tractor front support castings
- Porosity in brake drums
- Cracking in brake discs
- Cracking in connecting rods

Other Topics Discussed :

- Coreblowing techniques for amine process
- Design of corebox vents
- Methods of sand cooling
- Importance of pattern heating
- Importance of pouring temperature control
- Insulation practice for grey iron
- Part bar design and low elongation figures in ferritic SG iron

Eşçelik A.S.

Eskişehir

November 24th 1983

Cahit Doğan

General Manager

A steel foundry producing mainly wheel hubs for commercial vehicles. Most of the moulding is by hand, although three moulding machines have been installed. Coremaking is with greensand /dextrin, by hand, or for some special cores in furane. Neither moulds nor cores were painted.

There was little technical control - no measurement of pouring temperature, simple runner systems cut by hand without supervision, etc. There is no laboratory, although the equipment for this is said to be on order.

Most castings contain defects, and are weld repaired.

Casting Defects discussed:

Cold cracking and brittleness. It was not possible to see an example of this problem which was stated to be a serious, although not consistent, defect.

Advice was given to pay more attention to basic technical control before incurring expenditure on investigations into unusual metallurgical phenomena.

Sand and Slag Inclusions

Other Topics Discussed :

Use of alternative core making processes

Training of workers and supervisors

Metal de-gassing, killing, and pouring temperature control

Raw material inspection and selection

Future development plans.

Mr. W. H. Hays, Jr., Detroit A.S. Calderoni, Umberto, Asfalti, Genoa

December 8th 1985

Robertin Gasp	President
Ubaldo Ozzano	Plant Manager
Ubaldo Ronchi	Quality Control Manager
Ubaldo Atto	Production Manager

A mechanised foundry, belonging to the glass making subsidiary of Ispank. Production includes glass bottle moulds for the parent company, and also SG iron and grey iron castings for the tractor and commercial vehicle industries. Product quality is high, but internal reflections at about 10 - 20% represent a serious problem. Productivity is also low, output being restricted by electricity consumption controls. Production techniques are conventional, with mechanised moulding and corecasting equipment of Italian origin. Some castings are exported to the United States.

Castings Defects Discussed :

- Blow Holes from cores
- Turn-On from furane resin sand
- Sand inclusions
- Trashed and damaged moulds
- Chill and hardness in grey iron castings
- Shrinkage in SG iron
- Open grain porosity in chill-cast bottle moulds

Other topics discussed:

- Use of ammonia melting for duplexing to increase output from limited power supply.
- Feeder systems related to raw material selection and metallurgical control in SG.
- Heat Treatment of grey iron castings
- Productivity statistics
- Core storage
- Core box and pattern design, especially design of tolerances and details
- Organisation of Quality Control and Inspection

İzmit Çelik ve Makina Sanayi A.Ş.

İnönü Cad 271, Beşiktaş, İstanbul

December 7th 1983

Ömer Yenilmez Works Director
 Ali Kazlar Technical Manager
 Tahsin Hıncal
 Mustafa Erdoğdu

is iron- and steel- foundry, specialising in castings for the cement, ore handling, and mining industries, including a variety of wear and abrasion resistant alloys. Cement mill cylinders are chill cast from cupola melted iron, while rollers, hammers, plates, liners, etc. are sand cast and chill cast from electric melted alloy steels.

Despite the metallurgical complexity of the products and processes, the foundry employs no metallurgists. The technical managers are chemical engineering graduates.

Works organisation and technical control should be improved; however the product quality is adequate for the applications in the Turkish and Iranian markets at present.

Casting Defects Discussed :

metallurgical specification problems
 heat treatment Scaling and distortion

Other topics discussed:

Composition and production techniques for Ni-hard castings
 cupola operation improvements
 Necessary process and material changes if thin section stove plate castings are to be produced, as part of a planned diversification programme.

1983 Foundry, Ankara

10th December 1983

Alian Hargreaves Works Manager
 Malcolm Milne Foundry Manager

One of two foundries operated by the public sector (Tatne ve Kaya Endustri T.A.S.).

The Ankara foundry is situated near to the centre of the city, and is attached to the works producing railway and off highway vehicles.

The facilities are not modern, although two sets of moulding machines have been installed. Much of the production is manual, including castings for front and rear motor plates and trumpets for use in KKE steel loading trucks.

Defects Discussed:

Surface defects, various causes
 Slag inclusions
 Shrinkage

Other Topics Discussed:

Efficient utilisation of moulding machines
 Selection of core-making processes
 Improvement of technical control

Orsan Otomotiv Sanayi ve Ticaret A.S. Karabağlar, Izmir. 15th November 1983

Sezgin Orcaner Director
Mehmet Ersivri Foundry Manager

Orsan produces centrifugally cast cylinder liners for the Turkish and export markets. Close metallurgical (chemical and metallographic) control is applied in the foundry, and precision machining and inspection techniques in the finishing departments.

In addition to the centrifugal foundry, a small sand moulding section produces pistons for refrigerator compressors, and hydraulic control valve bodies.

Casting Defects discussed :

Core blowing defects on sand castings

Graphite morphology and metallurgical defects in centrifugally cast cylinder liners, including the effects of nitrogen from synthetic re-carburisers. Shrinkage and inclusions in centrifugal castings.

Other topics discussed :

Mould materials to maximise centrifugal casting mould life. A series of tests is to be carried out by TUBITAK (Marmara Institute) and suggestions were given into the material compositions for evaluation, including the use of vermicular graphite iron.

Mould life is the critical economic factor at Orsan, controlling mould costs and casting yields.

Coremaking. At present sand moulding is an insignificant part of Orsan output but they plan to develop hotbox coremaking for finned air-cooled cylinders. Present technology is not well applied, and suggestions for improvements were presented.

Pinar Döküm Sanayi ve Ticaret A.Ş. Pınarbaşı, İzmir 16 November 1985

Brun Karagözlü Technical Director
Yalçın Çay Development Manager
Nadir Goban Production and Technical Manager

A steel foundry specialising in wheel hubs and other commercial vehicle castings. Furane moulding is used, together with sand reclamation. There is also a greensand sand moulding area, and plans for the future installation of mechanised greensand production. Core-making is not mechanised, and less well controlled than the moulding.

Development work is being undertaken into the application of computer programming for metallurgical purposes, such as optimum charge calculations.

A routine Management Technical meeting was attended, and specific defect problems were introduced and discussed. Further detailed discussion took place on the foundry floor.

Pinar Döküm management provided the use of a meeting room for a more formal seminar training period on November 18th, attended by Pinar Döküm technical staff, as well as by participants from other foundries in Izmir

Casting Defects Discussed:

Hot tearing and shrinkage in low carbon steel hub castings
Blow holes in steel support arm castings
Metal Penetration

Other topics discussed:

Possibility of making exothermic or insulating sleeves from available materials
Design of runner systems for slag removal in steel castings
Problems caused by variation in properties of furane resins
Use of internal chills
Methods of venting cores for furane sand production.
Use of reclaimed sand with reduced binder content to improve breakdown of cores.
Applications of computer systems for casting weight and feeder calculation.

Safak Döküm Makina Parça San.ve Ticaret A.Ş. Menemen Yolu, İzmir .

16 November 1983

Vecihi Aksu. Foundry Manager
Halit Tanyeli
Mustafa Yalçın

A grey iron and SG iron foundry with a well-planned mechanised moulding unit, as well as a hand moulding section and a small centrifugal casting department. Hot-box, oil sand, and greensand cores are used.

Productivity and machine utilisation are not good, reject rates are high and the casting quality is below the potential of the equipment. Nevertheless the sales policy is to attract difficult work, such as complex diesel engine cylinder heads, which are beyond the skills and experience of the staff.

They were anxious for "text-book" metallurgical information, but lacked experience in practical foundry production, organisation and quality control.

Casting Defects Discussed:

Blowholes, related to core venting, especially on cylinder heads
Slag inclusions, related to poor runner system design
Surface sinking of SG iron castings
Crack Joint

Other topics discussed:

Design of runner and feeder systems for grey and S.G.Irons. The question was raised as to whether SEGEM could mount a seminar in the future on this topic.
Metal handling systems to avoid multiple ladle transfers and consequent loss of temperature resulting in casting defects, and also in reduced production capacity
The production of riserless castings in SG iron.
The composition of SG iron to achieve individual casting specifications.
Sources of information on International Specifications.
Sand properties and moulding machine operation to ensure the production of rigid moulds, without which it will not be possible to reduce the use of risers.
Methods of venting and sealing cores to reduce blowhole incidence.
Support systems for flaskless moulds.
The "trigger" process of delayed SG iron treatment
Methods of desulphurisation with Calcium Carbide

Turkish Sugar Fabrikeri

Eskisehir

25th November 1983

Kerim Dogdas	Works Manager
Ali Nivis Uz	Foundry Manager
Husein Ozdal	Foundry Technical Manager

The foundry is part of the Turkish Sugar Company machine production works, producing equipment for sugar refineries and other state enterprises (cement works, railways, etc) in Turkey. Separate sections produce cast iron, steel, and bronze melted in cupola, induction furnace, indirect arc furnace or fuel oil - crucible furnaces. Most of the moulding and coremaking is manual, although there is a small machine moulding section. A few cores are made in furane, but most are made in greensand with a bentonite and 1% dextrin binder.

Scrap is high, in the foundry and in the adjacent machine shop, and the quality of the castings which are accepted would not be adequate for most commercial purposes. However some complex and intricate castings are produced successfully. Formal technical control is not sufficient.

Casting Defects discussed :

Hot tears and shrinkage cracks in steel castings - partly due to lack of pouring temperature control

Surface roughness and expansion scabs

Sand and slag inclusions

Internal porosity leading to leaking of heat exchanger casings, probably due to the use of insufficiently clean chaplets.

Blow holes from wet sand.

Other Topics discussed :

Sand milling procedures and efficiency

Cupola blast systems

The need to avoid lead additions to cast iron

ump impeller core design

Runner systems and feeding systems for steel castings

Plant Working Fabricasi . Gevercik Yolu 26 , Gazi . Ankara November 11th 1981

Walter Dewey Foundry Manager
 Mustafa Kaya Metallurgical Engineer

The Foundry is an integral part of the Turk Traktor Factory, which produces Fiat combine tractors under licence for the Turkish and Iranian markets.

About 700 tons of grey iron castings are produced annually in a limited range of parts - the Foundry has inadequate capacity for all casting requirements a proportion of which are purchased outside.

The facilities are well mechanised, and well utilised. Casting quality is generally satisfactory, partly due to a good liaison between the Foundry and the machining and design staff. Scrap is held at below 5%.

A new electric melting plant has been installed and commissioned during May 1981, but has since been closed despite good technical results on account of the severe electricity rationing restrictions being imposed as a result of hydroelectric generating capacity shortages in Turkey following increasing demand and low rainfall. An old cupola plant is having to be used.

Casting Defects Discussed :

Slag Inclusions
 Hardness
 Voids in cores
 Misrun

Other topics discussed :

Dust extraction systems for electric furnace charging
 Use of computerised scrap recording and analysing systems

Yasar Dava Sanayi Ticaret A.S. Istanbul Karapinar 20 km, Ankara

15th December 1983

Nikola Günter Director

Yasar Dava are producer in a variety of sizes and are sold in the Turkish and Middle Eastern markets. The foundry produces the castings for the turbines, and also castings for outside customers, including pump factories in Iran, and electric motor producers in Turkey.

Production is semi-mechanised, using moulding machines, and a sand and conveyor system of their own design. Melting is by cupola.

The major foundry problem is considered to be core-making, with uncertainty over which process to adopt, and how to mechanise coremaking effectively. A request was made for an EPDC programme on this subject.

Castings appearance and quality is satisfactory for the applications, although internal rejections are higher than should be possible with a limited range of products for machining on site.

Castling Defects Discussed:

Blow Holes
 Cracks
 Blow and sand inclusions

Other Topics Discussed

The choice of coremaking process
 Break up problems with the CO₂ process
 Moulding box pin and bush system and maintenance
 Cupola operation and possible means of improving efficiency
 Plans for induction furnace installation.

APPENDIX IV

SEMINAR PARTICIPANTS

1. İZMİR	Company	Occupation	Years of Experience
Muammer BİLGİÇ	ORCANER	(Foundry Eng.) Met.Eng.	2 months
Erdogan DOĞRU	PINAR	Met. Eng.	5-6
Muhsin TÜFEKÇİ	BMC	Met.Eng.	3.5
Nadir ÇOBAN	PINAR	Met.Eng.	4
Sadi ERŞAHİN	ŞAFAK	Foundry Foreman	
Hüseyin AKINCI	ŞAFAK	Foundry Foreman	
Ali Rıza METE	ŞAFAK	Foundry Foreman	
Halit TANYELİ	ŞAFAK	Met.Eng.	
Ali Galip ERYILMAZ	PINAR	Technician Foundry Foreman	
Yalçın ÇAY	PINAR	Met. Eng.	2
Ersan KARAGÖZLÜ	PINAR	Asst.of Gen. Director	
2. ESKİŞEHİR			
Haldun ERTAN	ENTİL	Met. Eng.	
Mustafa ÖZER	ENTİL	Chem. Eng.	8
Ruhi AKSU	ENTİL	Moulding Supervisor	6
Salih VATANSEVER	ENTİL	Plant Manager	10
Süleyman KIZILKAYA	ŞEKER Fab.	Foundry Foreman	22
İsmail KUŞ	ŞEKER Fab.	Quality Control Technician	9
Hüseyin TUNA	ŞEKER Fab.	Foundry Foreman	21
H. İbrahim SIKI	ŞEKER Fab.	Pattern Shop Supervisor	19
Mahmut YILMAN	Sanayi Böl. Md.lüğü	Mech. Eng.	7

3. İSTANBUL	Company	Occupation	Years of Experience
Mahmut GÜNEY	ELMET A.Ş.	Met. Eng.	4 Months
Levent DOSTOĞLU	ELMET A.Ş.	Met. Eng.	1
Erden KARAESMEN	ELMET A.Ş.	Met. Eng.	1
Mustafa KIRIŞIK	DÖKÜMAY A.Ş.	Met. Eng.	7
Ata SEZGİN	DÖKYOL Dök.San.	Met. Eng.	9
Akın TULUNAY	SİNGER San.A.Ş.	Met. Eng.	5
Tayfun TEZANLAR	Ferro Dök.A.Ş.	Met.Eng. M.Sc.	2
Ömer GÜKKAN	Norm - 82	Met. Eng.	10

4. ANKARA

Bekir Sıtkı İİPER	YAZAR POMPA	Mech. Eng.	10
Kerim BİLGEHAN	MKEK	Foundry Eng.	5
Veyis SARIDUMAN	MKEK	Foundry Eng.	6
İlhan ERKUL	ERKUT San.A.Ş.	Met. Eng.	3
Sinan VAROL	ERKUNT A.Ş.	Met.Eng.	1
İlhami PEKTAŞ	ERKUNT A.Ş.	Met.Eng.	1
Ergun ATAMAN	MKEK	Met.Eng.	1
Abdullah GÜNDÜZ	O.D.T.Ü.	Met.Eng.	1

11.2.2. Training Programme in Foundry Coremaking Technology

11.2.2.1. Introduction

During training visits to Turkish foundries, undertaken in the course of previous ITI programmes, it has become apparent that there is a general lack of knowledge of coremaking technology, with resultant problems in the foundries.

In particular it has been observed that frequently there is :

- lack of knowledge of the available alternative coremaking processes
- a consequent frequent use of uneconomical or inappropriate processes
- inadequate appreciation of the precautions necessary to make satisfactory use of Turkish raw materials
- failure to apply proper coremaking Process and quality standards
- failure to make full use of its use to core problems
- poor design of cores and tooling
- poor maintenance of Coremaking equipment
- low productivity and uneconomic use of materials

As the Turkish Foundry industry develops in response to the requirements of a developing economy and engineering industry, and as the export of castings becomes more important, the implications of these defects will become more serious.

11.2.2.2. Objectives

A training programme should be organised by ITI, in order to improve the knowledge and skills of Turkish Foundry Technologists in the field of coremaking. It should cover an appreciation of the important factors to be considered in the design, production, quality control, and application of cores produced by available alternative processes; including processes already applied in Turkey, and those which have not yet been adopted by the Turkish industry. The programme should have a practical emphasis, and be arranged with a full appreciation of the special problems and conditions of the Turkish industry.

11.2.2.3. Topics to cover

- The use of cores. Functional requirements and alternatives.
- The design of cores, in relation to core production, casting quality, and economics
- Dimensional tolerances and methods of location and venting
- Coremaking materials : Sand, binders, additives including reference to the particular attributes of critical materials of Turkish origin.
- Laboratory control of coremaking processes and materials
- Review of alternative coremaking processes, including processes additional in Turkey and newer processes which have been, or might in future be, applied by Turkish foundries. Considerations of the practical and functional advantages and disadvantages of each process over the range of suitable applications.
- Coremaking production techniques, manual and automatic.
- Coremaking methods of cores and tooling.
- The maintenance of coremaking machinery and equipment
- The economics of coremaking processes and materials.

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- The different methods, core assembly, materials and methods.
- Factors of control and quality control in coremaking.
- Influence of coremaking on casting quality and casting defects.
This is particularly common in Turkish foundries.
- Environmental and occupational hygiene aspects of coremaking processes.
- The time and cost control in coremaking.

TRAINING PROGRAMME

The subject should be covered in a concise set of training notes; time should be allowed to translate these into Turkish before the practical on-site training is commenced.

The programme should include visits to iron and steel foundries, producing large and small quantities of castings by manual and by mechanised processes. Existing practice will be observed, to confirm and extend the observations made during earlier visits. Practical advice and assistance will be offered at the shop floor level, and in-plant training will be provided.

The programme should also include formal seminar training sessions, probably requiring a minimum of 3 or more days in view of the range of the subject and the possible unfamiliarity of some of the likely participants with important aspects of the subject matter. It may be advantageous to repeat the seminar presentation, modified to suit local problems, in more than one regional centre. Ample opportunity should be provided for discussion and questions.

As well as representatives from foundries, it may be found useful to arrange for some participation from pattern making companies, since it has been observed that many coremaking problems stem from corebox design and construction shortcomings.

