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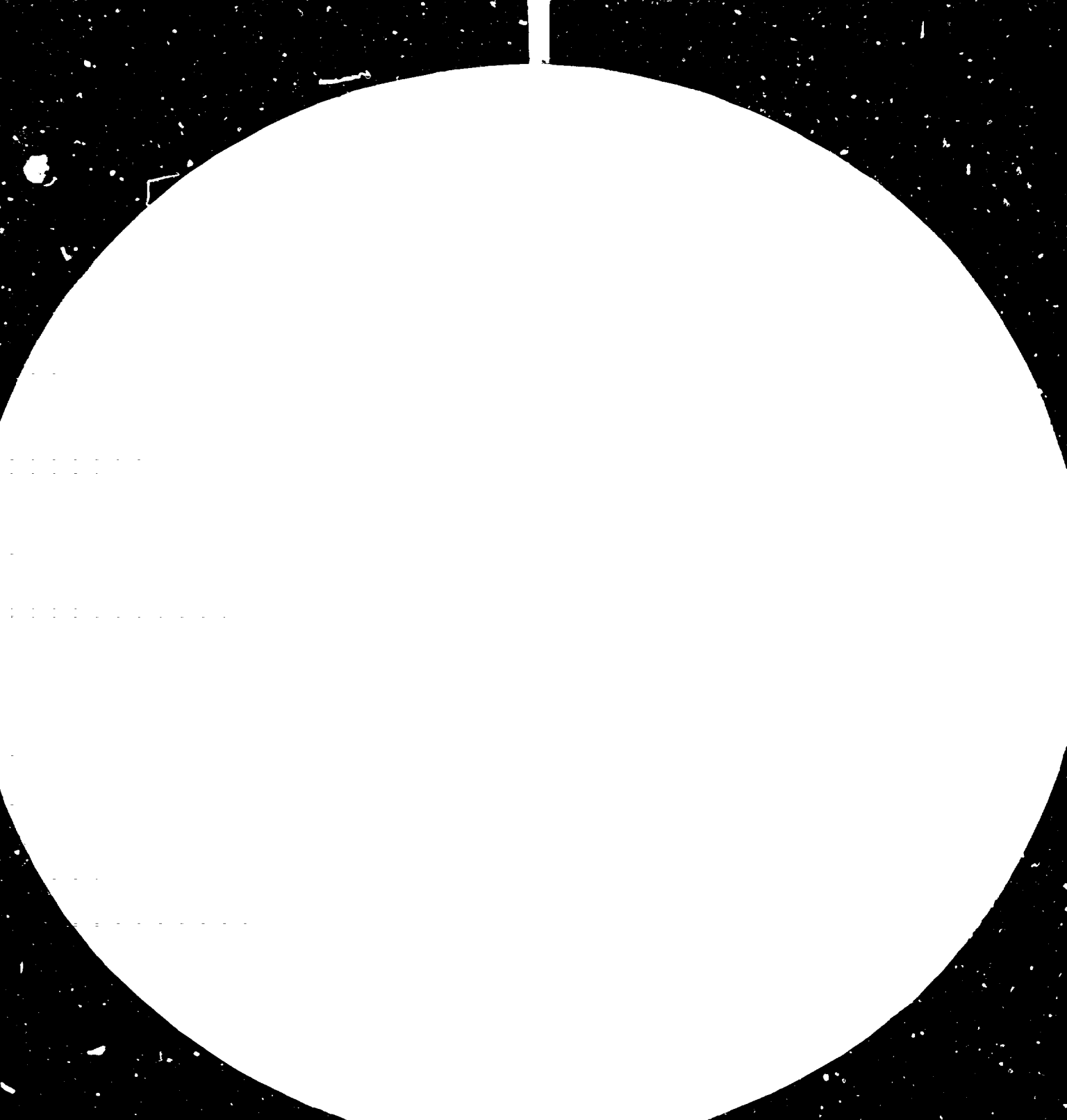

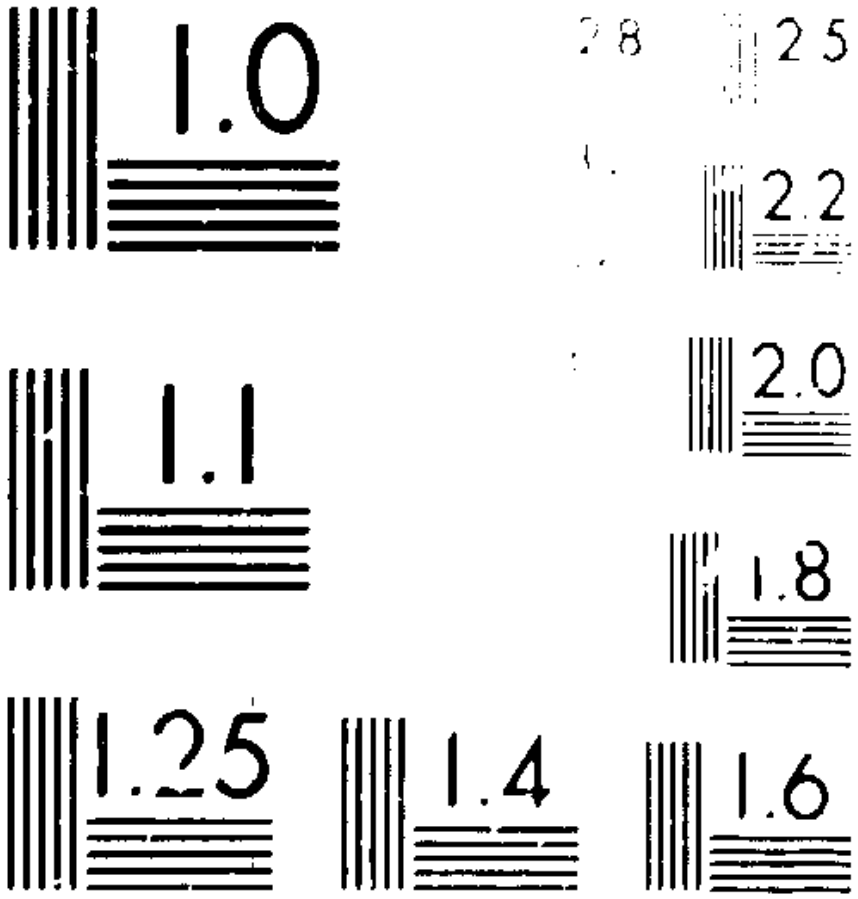
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ESTABLISHMENT OF A FLUID CONTROL RESEARCH INSTITUTE

DP/IND/81/030

INDIA

Technical Report: An assessment of the needs of the fluid control and flow measurement industries of India*

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

Based on the work of P. Harrison,
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United Nations Industrial Development Organization
Vienna

* This document has been reporduced without formal editing.

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1. Introduction

The project document IND/81/030/A/01/37 "Establishment of a Fluid Control Research Institute (Phase I)" lists as one of the two outputs:

"A comprehensive report containing a realistic assessment of the growing needs of the"fluid control systems/measuring instruments industry".

A study tour of relevant research institutions in India and an enquiry necessarily restricted in scope because of the time constraints of the whole project has enabled an assessment to be made and reported on as follows.

Whilst it was a straightforward matter to aquate the fluid control systems industry with the Indian valve industry, the beneficiaries from comprehensive flow measurement expertise and facilities that it is proposed to provide at the institute would not only be the, as yet, small flow measuring instruments industry, but a much wider group of user industries. These are currently without any acceptable source of flow measurement expertise or calibration facilities having established accuracy limits, against which flowmeters in operation in their plants can be checked.

Consideration was given to the needs of the oil hydraulic valve and control systems industry, but the majority of oil hydraulic valves are of the five port flow diverter type working in a well lubricated environment at regulated temperatures. They do not control the volume/pressure relationship in the same way as a flow control valve as used in the process control industry for example. It is recognised therefore that the problems of this industry tend to be of a different kind. To date all the hydraulic components and systems produced in India are developed elsewhere and good research facilities both in India and abroad appear to be available to the relatively few firms usually of foreign origin or with foreign linkages that specialize in the field of oil hydraulic systems. Accordingly their line of enquiry was not taken further.

Increasingly the standards documents and test codes issued by the standardizing organizations of the world such as the International Standards Organization or the Indian Standards Association are being used as the basis of contract specifications. The tests stipulated in these standards documents are often of considerable complexity and expense and require highly sophisticated testing equipment and techniques. It is often quite impractical for small industries to provide the necessary test gear and facilities and they are as a consequence unable to tender for lucrative contracts having a high technical content. This applies equally to the Indian valve industry and to those operating in the flow measurement field.

It is emphasized that an important function of any research institute is to increase its wealth of expertise and to increase its awarenems of the needs of the industries it serves. Thus their preliminary assessment of the needs of Indian industry is at best imcomplete and it will be an important task of the institute, and establish by its close contacts the research requirements of the industries it serves. Only then,can realistic reserach programmes be evolved, and research facilities of optimal use be provided.

2. The Indian Valve Industry

The Valver Division of the Association of Engineering Industries in India has a membership of some fifteen valve manufacturers. Some of these firms such as Instrumentation Ltd. manufacture relatively sophisticated shut-off and control valves in a wide size range, others concentrate on simpler types or smaller size ranges. However, all firms are, or will be, foaced with technical problems inherent in the development of new or expanded ranges of products and indeed there are many unanswered questions as their existing ranges are applied to new and developing processes.

It is clear that the present situation is unsatisfactory and that expertise and facilities are needed to help the industry produce products which will operate satisfactorily, safely and reliably in the user conditions required of them. The following table lists problem areas for the valve industry where facilities and information is lacking. The list is probably not fully comprehensive.

a) Material - Alternatives

- Resistance to - fretting and galling;
  - corrosion and jet impact;
  - cavitation erosion;
  - stress, temperature, creep;
  - nuclear radiation;
  - cryogenic conditions;
- Seals - Resistance to bonding with time;
  - soft seating requirements, permanent deformation;

b) Manufacturing processes
- hard facing techniques;
- bellows manufacture, fatigue characteristics;
- diaphragm technology

c) Fluid Dynamics and Valve Geometry
- pressure drop characteristics and pressure energy;
- control characteristics;
- cavitation inception determination;
- capacity determination for safety valves;
- flow mixing, turbulence and losses;
- torque, thrust and hydrodynamic loading determinations and stress analysis

d) Noise and Vibration
- noise measurement and analysis (fluid and liquid induced);
- methods of producing quiet designs;
- stem vibration analysis;

e) Valve Actuators
- response characteristics of systems;
- sizing and power requirements.

Whilst the above list appears fairly formidable, a good deal of information, expertise and facilities exist in India, which if they were known to the valve industry would go some way to providing solutions to some of the problems listed.

It is essential that full use be made of these existing facilities for to provide at the research institute the necessary facilities and disciplines to solve the problems listed above would involve a cost many times the sum allocated to the founding of the whole institute.

As an example of how the existing facilities in Indian Research Institutions might be exploited in the solution of one item in the above list i.e. cavitation erosion it may be noted that the Indian Institute of Science at Bangalore (only some 300 km from Palghat) has comprehensive test and research facilities for cavitation research and the effects of cavitation on materials. It has been working in this field for at least fifteen years. Furthermore, the technical literature of the world contains many references to the choice and use of materials having improved cavitation erosion resistance. Indian searchers requiring access to this information have it widely available to them at the National Aeronautical Laboratory (also at Bangalore) where the excellent library has facilities for satellite linked interrogation of the world's technical data banks. For a fee of 800 rupees a comprehensive search on any technical subject will be made and Xerox copies of relevant material uncovered by the search provided. At Chandigarh the Central Scientific Instrument Organization has a section working on the problems of surface analytical instrumentation and detailed analysis of damage to cavitation test samples can be rapidly performed. The cost of flying such samples to Chandigarh for analysis would not be significant. It is known that other surface physics departments exist in India and so the choice is not confined to one organization alone.

It is suggested that if good use were made of existing facilities and information available in India, answers to many of the problems listed could be found. Nevertheless, there are large areas particularly under the heading of fluid dynamics and valve geometry where expertise and facilities have not been found to exist and these it will be necessary to provide at the research institute in some sort of phased procurement programme according to an agreed list of priorities.

3. The Flow Measurement Requirements of Indian Industry

Relatively few manufacturers of flow-meters exist in India, Instrumentation Ltd. Palghat make some orifice plates, several firms made variable area flowmeters under license, and some watermeters are also produced. Other types of meter-, turbine meter, electromagnetic meter, etc., may soon be included in manufacturer's catalogue.

The apparent insignificance of the manufacturing side, however, in no way diminishes the importance of the subject to Indian industry. No facilities exist whereby the large number of flowmeters used in industry for custoy transfer transactions can be calibrated against accredited flow measurement standard facilities.

Research into the accuracies and methods of measurement of flow, be it through carburettor jets, or in hydro-electric penstock pipelines is so far not possible because of the lack of expertise and facilities. Discussions with the research institutions in India, particularly at the Indian Institute of Technology at Madras revealed that both for air, gas and water usage, they have regular enquiries from industry, particuraly the heavy industries for calibration of important flowmeters. They are unable to meet such requests due to lack of facilities.

The CSIO in Chandigarh have had plans for some time to set up water flow measurement facilities for developing magnetic and other types of flowmeter in pipe sizes up to 150 mm diameter, but would abandon these plans if facilities were to be built in the proposed Research Institute.

At the moment large oil and gas flows through pipelines do not appear to be governed by statutory requirements concerning the required accuracy of the measurement of flow through them. Since Government usually lays a duty or tax on the volume of products produced or transferred, the accuracy of the measurements is frequently questioned by the produces who wishes to pay no more tax than he has to and the relevant government department which is been to obtain a maximum revenue from the quantities sold. Depending on the country such interest may come under Ministries of Power Energy or Customs and Excise Departments, but utimately it is always found that the relevant department has no experience of the technical problems of flow measurement and looks for help to Research Institutions who can give detacted, unbiased and independent advice acceptable to both parties, and who can supply accredited calibrations of the flowmeters used.

In a world of finite and dwindling energy supplies and understanding of the role played by accurate flow measurement in the efficient use of energy is obviously vital. Energy conservation will become a subject of great importance to the Indian economy and again flow measurement expertise and facilities will be called for. In some countries all flowmeters of whatever type used for the sale of energy (in the form of steam or hot water) or fuel (liquid or gas) have to be of an approved type, installed in an approved fashion, and calibrated by an approved flow measurement institute. This is a world wide trend which may ultimately find its counterpart in India.

In the power industry, contracts for the supply of cooling water pumps and water turbines usually contain heavy penalty clauses for failure to achieve a fixed overall efficiency figure. In both cases one of the important determinants of efficiency is the measurement of the flow through the device and the relevant pump and turbine test codes stipulate in considerable detail how the measurements shall be made. Experience and skill is needed in carrying out the test and in the interpretation of their results since large sums of money are involved. It is customary to appoint an independent Flow Measurement Research Institution to supervise such contractual tests.

The problems of Indian manufacturers and users of flowmeters are not as clear cut and precisely formulated as those of the valve industry, perhaps because they have no national body to represent their interests. It is clear, however, that adequate calibration facilities for flowmeters are sadly lacking and should be a first priority in the staged provision of the necessary facilities for the future development of flow measurement techniques, metering and instrumentation in India.

4. The Need for Technology Transfer and Technical Information Dissemination

In such a vast country as India it is inevitable that the technically staff in the various organizations andmanufacturing companies in the field of flow control and measurement should feel isolated and without sources of the specialized technical information and expertise

that further developments in their field require good sources of information and some degree of expertise exists. The problem is to ensure that it is readily available to those who seek it and to educate technical staff to know how and where to look for it. Whilst it would be a prime function of the new Research Institute to make known the expertise and facilities of the organization and agressive marketing is called for, it is felt that much more should be done immediately and before the Institute is operational to improve the transfer to industry of the technology that is already available. Seminars, travelling exhibitions, visits to firms, information handbook etc., could all play their part and pave the way for the acceptance of the role of the new institute when it is opened.

5. Conclusions

Within the limitations imposed by the shortness of time available for the task a tour of India and visits to Research Institutions throughout the country has enabled an assessment to be made of the trowing needs of the fluid control and measurement industries. The research and testing needs of the valve industry have been fairly precisely defined, but the needs of the small but growing flow metering industry and the large number of users of flow meters is definite but not so quantifiable. In both fields much information of some expertise exists. It is a prime task to ensure that this is available to those in industry who need it.

6. Acknowledgements

Grateful thanks are due to the staff of Instrumentation Ltd. for making the tour arrangements and to Mr. V.K. Ramakrishnan of the Organization for his help and patience in conducting the tour.

APPENDIX 1

List of Visits

a) List of Research Institutions visited

1. Central Scientific Instruments Organization, Chandigarh
2. Instruments Design and Development Facilities Centre, Ambala
3. Institute for Design of Electrical Measuring Instruments, Bombay
4. National Aeronautical Laboratory, Bangalore
5. Indian Institute of Science, Bangalore
6. Central Machine Tool Research Institute, Bangalore
7. Indian Institute of Technology, Madras

b) List of Companies visited

1. Instrumentation Ltd., Palghat
2. Vickers Sperry of India Ltd., Bangalore