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SUGAR PRODUCTION /EQUIPMENT/ CHARACTERISTICS AND /SPARE PARTS/ 1/

by

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SUMMARY

Attention is drawn to the high degree of self sufficiency normally associated with a cane sugar factory. Beet factories and refineries tend to become less so when located more conveniently to sources of supply.

Equipment selection may be in group units or individual items.

Characterisation involves capacity ratings, specification of leading dimensions, nature of services, siting requirements, safety protection, and environmental interaction.

Possible weaknesses in using over-all rating for characterisation are mentioned. Inter-relationship of equipment capacities to avoid or identify bottlenecks is needed.

Spare parts are a major capital investment and need proper itemisation and classification with efficiency in accessibility and replacement. Obsolescence is an important criterion to be noted.

Workshop equipment needs to be adequate, well laid-out and efficiently used. The worth-whileness of in-service training of skilled operators is mentioned.

A. Introduction

A decision on equipment requirements is only possible once the process flow sheet has been speficied. It may be that several alternatives must be evaluated within a particular flow sheet in which case the various alternatives need to be specified and appropriate equipemnt characterized.

Most raw sugar factories are very largely self-sufficient which is traditionally related to their relative isolation and long periods of delay in obtaining equipment from established suppliers. Improved international communications with the benefit of rapid air-freight in emergency situations has gone some way in easing this problem. Nevertheless sugar cane factories are still capable of a wide range of repair and construction operations.

B. Equipment Selection

There are two broad categories within the framework of which we might considered proposals for equipment selection. One is to group equipment which is needed, for example a train of milling units with associated auxiliary equipment. The other is to identify a single unit of equipment such as a massecuite pump.

There are many manufacturers of equipment operating internationally and whose business it is to tender for group units. On the other hand there are also specialist manufacturers who prefer to concentrate their endeavours on particular items of equipment.

C. Equipment Characteristics

The first and most important characteristic of any item or group of items of equipment is that of capacity. It is then necessary to specify the conditions under which this capacity is desired and the margin of fluctuation which can be tolerated or may be desired.

It is not unusual, by good management, to obtain 10 to 20% or even more in capacity from particular equipment than the figure guaranteed by the manufacturer. There are circumstances under which equipment cannot be used over the full range from the rated value down to zero. Positive displacement pumps driven by a constant speed motor fall within this category. Diffusers, especially for sugar cane, are difficult to operate under conditions much below those for which they are rated.

The conditions for operation of equipment usually involve the provision of services by the operator. These include such items as electricity, water and steam. The quality of the services needs to be specified - voltage and frequency in the case of electricity, pressure in the case of water or steam. Capacity values may also be important for the supply of water or steam. Similar comments might apply to compressed air or vacuum. The cleanliness of compressed air - i.e. freedom from oil - is another criterion on which importance is often placed. Steam may need to be free of oil or water.

The situation in which the equipment is to be installed is the responsibility of the operator but needs to be clearly defined to the supplier. Siting of heavy equipment such as mill roller units requires a careful study and good understanding of foundations.

The vibrations likely to be transmitted through the ground or through structural elements from mills and cane preparation equipment such as knives and shredders can be important. This should be taken into account when locating laboratories especially juice laboratories which are not infrequently located within the proximity of the first mill. Such a site is, in fact, probably quite satisfactory for a juice laboratory minimising transport problems for samples and for waste from the laboratory. The main analytical requirements for juice laboratories are polarisation and brix. If any weighing procedures are to be conducted then freedom from vibrations assumes importance. Problems begin to arise in these areas once a juice laboratory is extended to include whole cane analysis which required sample weighing and weighing of dried fibre. The latter is likely to be influenced more than the former as the weight of dried fibre

is only about one eighth of the weight of sample and a more sensitive balance is used.

Vibration problems from a milling train can be very difficult to forecast or to cope with when they do arise no matter where the laboratory may be located as they can be transmitted through the ground and/or structural elements for quite long distances, and there are many weighing operations requiring the use of quite sensitive balances in the main control laboratory.

Under general characteristics of equipment is the need to provide for safety and protective measures. Covers should be specified for screw conveyors or vessels with ribbon stirrers. The latter are usually overlooked in the case of massecuite receivers or crystallisers. Nevertheless safety fences should be appropriately provided. All potential hazards are not easily anticipated, but a specific checking of all items in a group equipment design should be made solely from the point of view of safety and potential hazard with respect not only to regular operating personnel but also to casual visitors who can be expected in the vicinity during operating periods.

Associated with general safety requirements should be the effect of noise. Very little attention has been given to noise abatement in a sugar mill. A beet factory or a separate refinery have many fewer problems from this point of view than does the cane mill.

One source of noise (intermittent) which is common to all sugar factories is the vacuum breaker on the sugar boiling pans. Whilst this operation is in process a very high intensity noise level is generated. Steam expansion is another possible source of noise but not so frequently encountered. Electrical braking of centrifugals and possibly acceleration can be short term but frequently repeated noise sources.

The cane milling train is probably the greatest generator of noise. Mills can emit a "growling" which can become quite obnoxious depending on the frequency and intensity level. This is believed to be related to the movement of cane over the trash plate and often erroneously

thought to be an indication of good work. The primary gear train between a turbine and a mill generate a high intensity of sound. The shredder and cane knives probably rate next in sound intensity.

It is unusual to specify means for modulating sound so generated but in the interests of operator efficiency and well-being attention should be given to this factor.

D. Design Characteristics

It is common practice when designing sugar factory equipment to use more or less rule-of-thumb procedures. This involves using only gross capacity ratings for the purpose.

A well experienced and well informed sugar factory engineer can often take advantage of such techniques by being able to extend the capacity of equipment in real operation by substantial margins. Suppliers of equipment do not generally view such activities with very great favour and it is not unusual for them to raise strong objection or even to build in a "weak link" to act as an overload protection.

Correct design involves a detailed understanding of the behaviour characteristics of each individual item of equipment. Heat transfer coefficients for evaporators and correct materials and energy balances are very important items in the correct characterization of these items of equipment.

Much less is known about the detailed behaviour of cane preparatory devices and milling units and it is largely necessary to depend on capacity ratings.

Care must be exercised with any equipment when employing capacity ratings. The manager is usually concerned with over-all ratings in terms of product or raw material processed. The operation engineer, however, recognises that his evaporators function in terms of water evaporated per unit of time.

Pan boiling equipment may be evaluated in terms of capacity of sugar or of massecuite. Rate of evaporation may however be a controlling factor if the evaporators are not delivering syrup of appropriately high concentration or difficulties are experienced in discharging massecuites as and when required.

The inter-relationship of equipment and the correct identification of bottle necks are important in evaluating over-all capacity of operation.

E. Spare Parts

Sugar cane mills are usually located in isolated areas and it is necessary to maintain a good supply of spare parts.

On the other hand it is very easy to carry an over-supply of spare parts for items which do not require replacement as frequently as had been anticipated or has become obsolete. Unprepared obsolescence is often more conspicuous in the spare parts stores than in the factory itself.

All machinery and equipment should be studied in detail and spare part estimated prepared.

These should than be classified into:-

(a) Those which can be fabricated locally
(b) Those which can be purchased locally or within the country
(c) Those which have to be imported

The supply of spare parts should be adjusted appropriately with material required for fabrication being either kept in store or known to be available locally with the minimum of delay.

Some cooperation between sugar factories located within a district or owned by a common group can be of material advantage where large equipment is concerned. The sugar milling fraternity is such that assistance is not unusual in an emergency. The point should be made that under

conditions of good management emergencies do not arise.

Knowing what spare parts and materials are actually in a sugar factory store is also an important item of accounting. The factory engineer should make himself thoroughly familiar with the detailed store situation at regular intervals in order to avoid an undesired depletion of spares on the one hand or the accumulation of unnecessary spares on the other. The balance of these two represents the achievement of good management. Efficiency in this area can be improved by a knowledge of estimated life of individual items of equipment. It is unusual to itemise such except in the larger and more efficiently organised factories. Nevertheless this should be the aim in all factories. This is the direction in which advice would in all probability be given if the services of a technical consultant group were professionally retained for the sole object of reporting to the management on the spare parts situation.

Questions:

1. What characteristics are important in the specification of sugar factory equipment?
2. How should we go about obtaining the required information?
3. What is considered a reasonable provision of spare parts?
4. How can we best keep this under control?
5. At what stage would computer operated store control be feasible?

F. Workshop Equipment

As has already been pointed out, sugar factories and especially cane sugar mills are largely self-sufficient. This involves the establishment of appropriate workshop facilities.

The lay-out of the workshop is important for efficient operation but it is difficult to achieve a satisfactory lay-out until a decision is reached on the scope of activities. Provision should also be made for new techniques in fabrication and maintenance.

The electrical equipment requires its own workshop with adequate facilities for handling the maintenance jobs called for by sugar mill operation. It is not good enough to dismantle and perhaps even rewind a high quality motor on a dirt floor with inadequate lighting no matter how good the tooling equipment might be. This is common enough for the author to consider it to be worth a mention.

Adequate lathe facilities able to handle anything from a sugar mill roller to precision parts for instruments are required for effective coverage in isolated communities. Appropriate provision of related up-to-date machine shop equipment is needed to maintain a good balance of operations.

A suitable plate shop with plate and pipe bending and cutting equipment as well as facilities for arc and gas welding and cutting.

All of this requires skilled tradesmen. The provision of adequate training facilities is important in a developing country. Too often these are overlooked and operating staffs are minimised. It is very desirable to take a long term view with a well organized apprenticeship system. This also up grades the skills of the local community in an otherwise isolated country town.

Inevitably there will be transfer of skilled operators to other sugar factories or even to other industries within the local town area. In return skilled operators can from time to time be expected to transfer from other sugar factories. Any up-grading of skills within the local town area should be looked on as a service provided by the sugar mill and in the long term interests of its own development.

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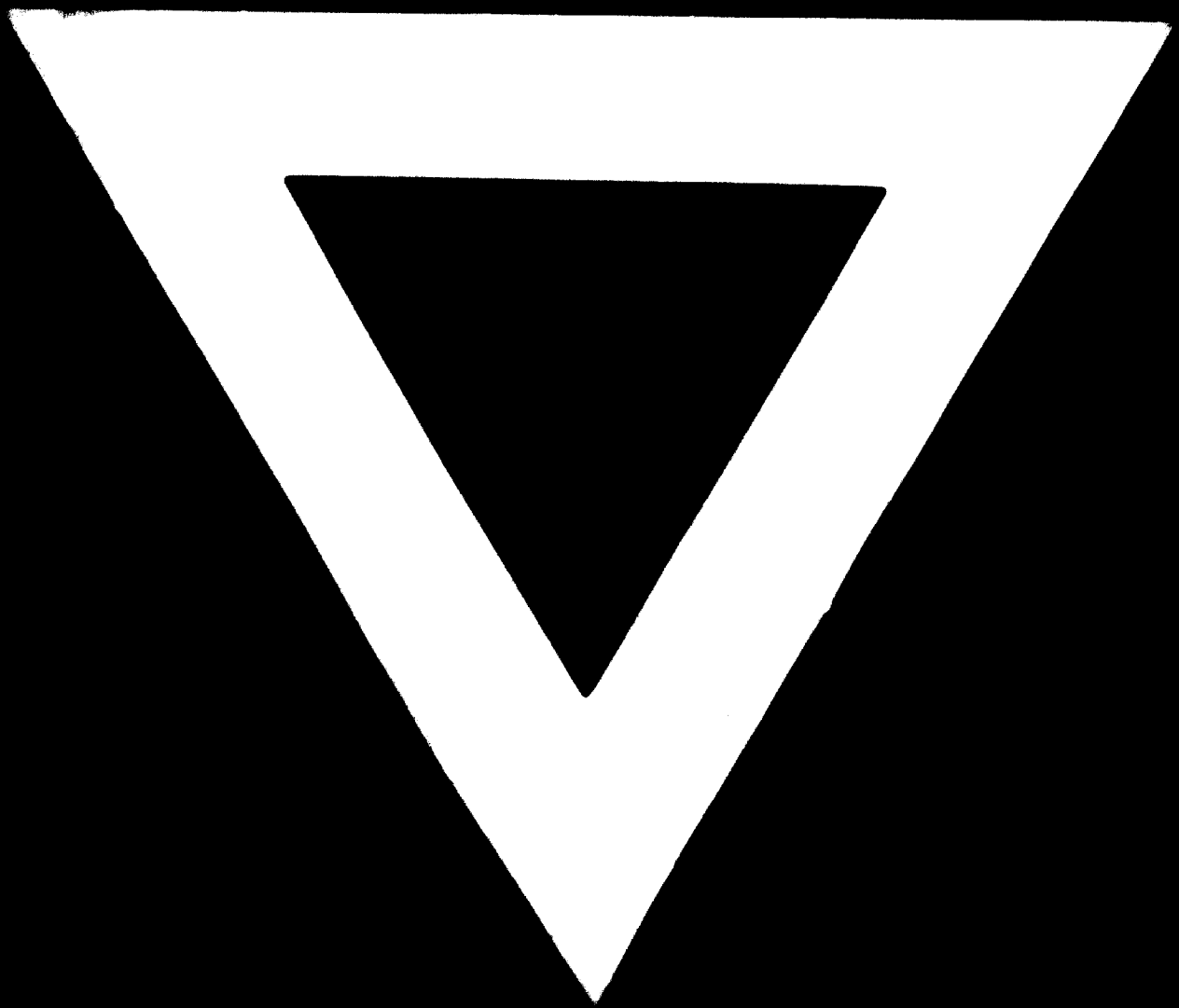

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