

As described earlier, the need to replace/add new equipment should be firmly established and an approximate budgetary provision should be made. Prima facie, the investment should have a reasonable payback period, *which is acceptable to the management* after a cost–benefit analysis is done (benefits expected and costs involved for the operation and maintenance of the new equipment.)

Technical specifications should be worked out by design engineers in consultation with the shop floor/operational staff. These should also be examined by experts and the management (while carefully considering the future marketing and production plans of the company, the actual working and climatic conditions, etc.).

This is necessary if large investment is involved for the new equipment.

Inquiries and further action for procurement should commence only after this, so that time, energy and money is not wasted in clarifying various doubts/queries raised by fabricators and suppliers.

*Suitable alternative specifications should be worked out in advance so that in case equipment is not available as per original specifications (or would become available after delay), one can proceed to procure the next best machinery. This is only for making a compromise in some special situation—the need to meet urgent demand for the product by a prestigious client or immediate replacement of a key machine, which has broken down.*

However, care should be taken not to dilute the critical specifications too much, e.g. (i) use of mild steel (MS) instead of stainless steel (SS) or (ii) use of thinner gauge sheets, which can result in inefficient or unsafe (or both) performance.

The following pages present the guidelines for procuring process plant equipment by considerations of important specifications. The following broad classification of the equipment is done in order to analyse the expenses on main production units, utilities, auxiliary services, etc. The expenses can be booked under the heads of new projects, major revamping/modernisation, annual maintenance shutdown jobs and regular maintenance.

The classification is thus as follows:

- Facilities for feeding of raw materials
- Reactors and main process equipment (e.g. heat exchangers, filters, etc.)
- Heat recovery, steam generation and utilisation equipment
- Auxiliary equipment
- Material handling equipment
- Utilities and heating systems
- Instrumentation and process control
- Laboratory facilities
- Protective linings, insulations and cladding
- Effluent treatment plant, scrubbing systems, waste disposal
- General equipment
- Product dispatch
- Maintenance facilities
- Fire fighting system
- Personal safety items

---

## 2.1 Instructions to Vendor

Data sheets and inquiry document should be prepared by mentioning specific details for the items to be procured as per broad classifications given.

The purchaser should instruct the vendor to send the offer documents, which should fully comply with data sheets, general conditions mentioned and instructions given in the inquiry document.

The offers can be compared on this basis and shortlisting of vendors can be done.

The data sheets must specify full details of the following:

- Required performance during normal operation *along with lower and upper limits*, i.e. in case of a pump, the lowest and highest capacity and discharge pressures required can be given in the data sheet. Likewise, the operating temperatures, concentrations, etc. under normal condition as well as minimum and maximum values can also be specified.
- *The vendor shall also provide complete performance data of equipment offered (e.g. capacity-head-power-speed curves for pumps).*
- **Material of construction (MOC)** of all parts should be suitable for site and process conditions as given by purchaser.
- The inquiry document must clearly define the performance guarantee terms with respect to all outputs from the equipment and the consumption of all inputs such as power, water, steam, raw materials, etc.
- Test certificates for all MOC and all bought-out components should be given by the vendor.

A general arrangement drawing showing the battery limits of scope of supply must accompany the offer. It should also show preliminary layout, overall dimensions,

weights, maintenance clearances, and maximum erection and maintenance weight for main components.

- The space required for installation of the unit and for maintenance activities later on should be clearly indicated in the offer. This may include cleaning and replacement of internal tubes, tower packing, impellers of blower, replacement of belt drive pulleys, etc.
- Instrumentation of the equipment should be offered in a calibrated and fully tested condition.

The vendor can also offer an alternative arrangement (if he has supplied it earlier) for the complete assembly; but without additional cost to the purchaser. The vendor should give at least two references where this alternative arrangement has been working satisfactorily for at least 2 years (or 16,000 h running).

- The design and fabrication must not violate any statutory regulations, and should be as per international industrial codes and standards (e.g. ASME Sec VIII, JIS, IBR, etc.) followed by latest amendments unless a different specification is mentioned in the relevant equipment specification data sheet. The offer shall be made on this basis.
- Good engineering practice and industry standards should be followed if no specifications are given in data sheets and no critical application or handling of dangerous, toxic or inflammable materials is involved. *However, as a matter of precaution, the purchaser should obtain approval from statutory authorities of such equipment before using them.*
- In case of any discrepancy/conflict between requisition and its associated specifications, data sheets and the codes, standards and regulations, the vendor should bring the matter to the purchaser's attention for resolution.
- The vendor should mention the thickness of vessels and corrosion allowance as well as test pressure.
- Suitability as per process flow diagrams and piping and instrumentation diagrams must be confirmed by providing all inlet and exit nozzles and their orientations. Overall dimensions and weight must not disturb other process unit and structural supports.

#### Noise Limit

- Unless specified otherwise in applicable standards, the sound level should not exceed 85 dB at 1 m from casing/surface and 1.5 m above the equipment base. The control of sound to meet this requirement shall be the sole responsibility of the vendor. Suitably designed silencers or acoustic enclosures should be provided by the vendor at no additional cost to purchaser.

The vendor should include all additional items that he deems necessary for proper completion and safe operation, in order to satisfactorily achieve the process and mechanical requirements even though such items may not be mentioned in the

data sheets. The vendor should clearly state technical exceptions or deviations that may be considered by the purchaser. If no exceptions, exclusions, optional parts or separate prices are specified it will be assumed that the offer is completely in accordance with the requirements of the purchaser and applicable specifications, drawing, codes and standards will be followed. In case this is not possible, the vendor must give a list of exceptions and deviations in his offer.

### 2.1.1 Exclusion from Scope of Supply

- Items required by the purchaser in his requisition and their relevant applicable specifications but not included by the vendor in the offered *scope of supply* should be specifically listed in the offer under “exclusions.”

The vendor shall also specifically mention all items that are necessary but will not be supplied. *These will have to be arranged by the purchaser at and will cost an additional amount.*

Additional equipment that are not a part of the equipment being offered but are necessary for the proper, safe and smooth functioning of the same can be clearly mentioned and offered by the vendor as an *optional extra supply* in the offer. Charges for these items should be mentioned separately.

### 2.1.2 General Conditions

An inquiry document should mention the following:

The following points should be easy:

- To flush out and clean the equipment before taking up a maintenance job. Complete draining out should be easy and safe. There should be minimum residual quantities of toxic or inflammable material in crevices or idle pockets.
- To open the equipment for inspection and replace damaged internal parts.
- Easy to understand the construction, operate and carry out maintenance.
- To carry out breakdown maintenance and replacement of internal parts.
- To vent out internal toxic or inflammable gases. (Provision of bolted manholes instead of welded manholes wherever possible—but not recommended for high pressure or units handling dangerous materials.)
- Safety devices and interconnections as required by the purchaser should be provided by the vendor to ensure safe and trouble-free working.
- The vendor must provide lifting lugs/eyes on the equipment and all special tools required to remove and re-install components.
- The vendor should supply sufficient spares for commissioning as well as ensure 2 years smooth operation considering normal wear and tear.
- The vendor may give his standard sub-vendors’ list, but these shall be approved by purchaser.

- The equipment shall be fully assembled on a transportable base plate and delivered in the minimum number of sub-assemblies to minimize site activities.
- Parts of equipment or instrumentation shall be properly tested and packed. Each sub-assembly shall be complete in all respects at time of final inspections. They shall be tested as per standard methods/tests agreed.
- All items shall be packed in appropriate seaworthy/weather proof manner for safe transportation. Weights of items and dimensions of each container shall be clearly informed.
- The equipment shall be fully assembled on a transportable base plate and delivered in the minimum number of sub-assemblies to minimize site activities.
- First fill of all lubricants, greases, etc. to be given free of cost by vendor.
- *Equipment delivery:*  
The vendor should clearly mention the final delivery schedule of the equipment from date of (starting from commencement of the job) technically and commercially clear order.  
Schedules for stagewise inspection of different parts and tentative final inspection schedule of the equipment should also be given.
- The vendor should agree to provide drawings for civil foundation or for locating foundation bolts on placing order. If special foundations bolts are required then they should be supplied by the vendor.
- The vendor should agree to provide site assistance for erection and commissioning—either free or on a chargeable basis (*to be written in offer*).
- The vendor should give the details of site arrangements to be kept ready by the purchaser before the equipment is despatched from vendor workshop. This should include power, water, chilled water, steam, compressed air, fuel for initial heating, etc.

The vendor should offer the following items and services with separate quotation:

- Spares for smooth operation for 2 years which are necessary for replacement due to normal wear and tear.
- Training at vendor workshop or at a plant where similar equipment has been running satisfactorily for past 2 years and at site (lumpsum price). The training should be for at least two engineers, operators and maintenance technicians deputed by the purchaser. Generally, expenses for such training are paid by purchaser, but they can be shared with vendor also. The duration of training can be worked out mutually.
- The vendor should provide at least three copies each of the erection, commissioning, operation and maintenance manuals.

The vendor may be asked to offer an annual maintenance contract for the equipment offered by him. This can ensure proper servicing and replacement of worn out spares by Original Equipment Manufacturer (OEM). Besides, the equipment should be handled by trained technicians only.

*While awaiting the offers, the purchaser may internally discuss with his own technical team about the possibility of reuse of some items from existing old units such as:*

*Supports and grids from filter, converters, trays from distillation columns, body or shells of units, some usable catalyst, active carbon, filter cloth, tower packings, lubricating oils, instrument cables, refractory waste, molecular sieves, etc.*

---

## 2.2 Quality Assurance Plan (QAP)

The purchaser can ask for this while floating inquiries also (for costly, intricate, high-tech machinery or for bigger procurements like a complete plant).

However, the shortlisted vendors must be asked to send the QAP to enable final selection and negotiations.

### 2.2.1 The Vendor Should Include in the QAP

- Codes and standards followed by the vendor while designing and fabricating the items.
- How is the material tested? In house/outsourcing with test certificates
- Storage facilities at vendors' shop should be open for inspection
- Traceability of material—procured, stored and issued for fabrication—whether the same material (e.g. *boiler quality steel plates*), *which was tested earlier has been stored properly and is used for fabrication for the purchaser's order.*)
- Stage inspection during fabrication
- Final inspection and performance test—if possible at vendors' shop

### 2.2.2 Visit by Purchaser's Inspection Engineer to Vendors Works

- Visual inspection of the unit, to check accuracy of overall dimensions, calibration of tanks
- Ease of maintenance—to open, clean, flush, lubricate, replace parts and internals
- Fitment and alignment accuracy
- Physical and chemical test of MOC used
- Surface preparation and internal inspection report by contractor
- Hardness test
- Ultrasonic test for thickness
- Radiography test and dye penetration test—for welded joints
- Welder's qualification and weld procedure test—before starting fabrication of pressure vessels
- Post weld heat treatment
- Pressure test, Indian Boiler Regulations (IBR)/other statutory agencies' compliance certificate

- Balancing of impeller/moving/rotating parts
- Vibration test
- Performance test—capacity, head, power consumption
- NO load/free running test
- Load/overload test
- Measurement of speeds
- Acoustical test
- Manufacturer's test certificate for bought out items
- Spark test of lining for rubber, glass, Poly Tetra Flouro Ethylene (PTFE), fibre glass linings
- Load/deflection test of specimen

### 2.2.3 Documents to Be Included in the QAP

- Approved GA drawings and other reference drawings
- Stamped drawings, which will be released for fabrication/manufacture
- Relevant catalogues of bought out components
- Line/layout diagrams (*this is for confirmation of scope of supply*)
- Approved erection procedures will be given afterwards
- A copy of unpriced purchase order with specification and amendments, if any. *This is for confirmation of scope of supply (during visits for inspection) as reference only*
- Calibration certificate of all measuring instrument
- Guarantee certificate

Process Equipment Procurement in the Chemical and  
Related Industries

Golwalkar, K.

2015, XXI, 259 p. 33 illus., 12 illus. in color., Hardcover

ISBN: 978-3-319-12077-5