WRITING A GOOD SPECIFICATION FOR ENQUIRY DOCUMENTS

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GENERAL INTRODUCTION

The extremes in enquiry documentation :

1) Please supply price for dust collector for our furnace.

2) An Iscor or Escom document of 400 pages spelling out volumes temperatures filtering velocities plate thickness and wind directions and number of toilets.

The ideal is obviously a balance between these two extremes. We will try to establish during this session the major factors that need to be provided by you the clients to allow the contractors to provide meaningful tenders for adjudication, which in turn will lead to the installation and operation of a successful system.

To make the task of formulating an enquiry document easier we suggest the use of a standardized proposal data list as prepared by the Gas Cleaning Association. (Appendix 1)

SECTION 1

This section is self-explanatory but highlights some general points which are very important for the contractor i.e. communication, information which indicates how much time needs to be spent on formulating a tender.

SECTION 2

This section is for the purpose of describing the plant, process or application. Without this information the Contractor cannot make the correct equipment selection or recommendation.

Give a full description of the process or equipment generating the gas to be cleaned.

State the boiler, furnace kiln etc. type and give as much detail as possible about the type, make output, continuous rating, peak rating and variations in operation.

Specify whether the equipment is for a new or existing installation.

Describe raw materials and if possible give analyses. If it is intended to use various types of raw materials information on type and the proportions to be used should be given. State which type will generally be used and for which the efficiency guarantee will apply.

This may seem a fairly unnecessary requiest, but to highlight how it can influence the design and operation of a plant let me give you two examples, from my own experience, where either incorrect or incomplete information has led to major problems after the installations were complete – both illustrations being from the steel industry.

1) We had a request to supply a fume extraction system for a 30 ton electric arc furnace producing steel.

   The system provided incorporated a direct extraction system with watercooled duct leading to a forced draught cooler and bagfilter unit.

   All the necessary information was gathered prior to final design and the application was considered to be fairly standard in our experience.

   After some 4 months operation extraction was lost at the furnace and investigations revealed that the cooler was blocked.

   The cooler consisted of 300 or so 100 mm diameter tubes through which the hot gas flowed – cold air being blown across the outside of the tubes for cooling.

   The tubes were blocked top and bottom. After cleaning the cooler proceeded to block up every two weeks.

   After many tests it was established that there was in excess of 35% zinc oxide in the dust making it very sticky. It was found that this excessive amount of zinc outside was generated from the galvanised mild steel scrap being used in the furnace.

   When questions were asked during the design stage the raw materials were stated as 100% mild steel scrap, no mention of galvanised scrap.

   Yes we were at fault as well as the client, as we did not highlight or mention that the use of galvanised scrap could influence the design of the system. Had we known we would have not utilised a forced draught cooler with 100 mm diameter tubes and the client would not have been landed major extraction problems.

2) The other example is also related to raw materials being fed to an arc furnace. On this high power arc furnace the major raw material was sponge iron, oxygen being the major influence on the heat generated in the furnace during melting and decarburising.

After installation and some months after start up severe heating problems were being experienced.

Cutting a very long story short it was discovered that the sponge iron being used was of a sub-standard quality containing much more free oxygen than used in the design. Moreover it was found that, in order to minimise production time of each batch of steel, the operators were "banging" in 50% more oxygen than was incorporated in the design.

We were therefore forced to point out to the client that their raw material was sub-standard and outside specification and that the operators were operating outside the design limits of the extraction plant.

If a collector exists on a similar application within your company indicate its type and rating.

SECTION 3

In many companies the resources may not be available to establish extraction volumes and you would be relying on the Suppliers to establish the requirements.

Certain requirements and principles need to be adhered to, to ensure good dust and fume capture. I outline some of them below to allow you to consider establishing a preliminary volume yourself or at least to ask some relevant questions of the Supplier.

1) The major principle is to collect dust or fume at a point which is as close to the source as possible.

2) Correct hood design and configuration should be achieved to give maximum access for good operation and maintenance as well as good dust control.

3) Open areas and hence ingress air should be minimised to keep the overall extraction requirement down.

   Relating back to point 2 a good balance should be achieved between minimum open areas and general/maintenance access requirements. If a figure for openings is agreed and then during operation these open areas are considered not practical, the effective dust capture velocity is reduced and the efficiency of the system is destroyed.

   The principle ot be achieved is that of equalling the rate of generation of dust and air movement within the operating unit and hood by the ingress of air through the open areas.

   In the case of a fume generated in a hot process the rate of fume rise may be 3 m/sec – it is therefore necessary to match this by ensuring that the ingress of air through the open areas around the hood exceeds 3 m/sec.

This section specifies the operating conditions for the collector listing :

1. Gas volume – continuous, peak and variations.

2. Volume on which performance guarantee is to be based.

3. Gas analysis – as this may affect gas density and hence sizing.

4. Moisture content – again this will affect either the sizing or the decision as to whether a bagfilter could be used.

5. Nature of the dust to allow for designed sizing of hoppers, collector support steelwork and dust conveying system.

6. Unusual characteristics of the dust may affect collector selection, provision of explosion venting, provision of flow assisting devices.

   If a representative sample of dust is available this will help, but the most realistic information can be gained from practical experience by the client.

7. If a particle size analysis is available state the basis – weight or number and the method of establishing the analysis.

8. Dust concentration if available is essential to allow the Contractor to give a realistic guarantee. If you are unable to establish the concentration you may either have to rely on the Contractor's experience or have the loading measured by some outside agency.

9. Barometric pressure or elevation at plant site – an absolutely vital piece of information without which the system cannot be designed.

10. Other general operating conditions or requirements which may be felt relevant.

SECTION 4

The required performance should be established by direct contact with Capco or with your local inspector. The Contractor may be able to advise, but ultimately the operator must conform to the legislation laid down by the Chief Air Pollution Control Officer.

Generally Capco will advise a final emission figure in terms of mg/m^3 and not a specific collector efficiency.

SECTION 5

Layout or location of a collector obviously plays an important part in the design of a total system. The routing of duct work in particular can affect significantly the pricing but also has to be fairly closely defined such that the system resistance and hence the fan static can be established reasonably accurately.

SECTION 6

Although most suppliers have standards to which their equipment is normally designed, the client may however have good reason to request specific design features.

It is suggested that the client has very good and relevant reasons for requesting changes to basic design levels of dust collectors as this will no doubt significantly increase the price. Changes in design pressure and temperature will result in a re-design of the casing and the production of a non standard unit.

Where a scrubber unit is being considered the quality and availability of water should be clearly stated. Effluent treatment requirements and availability should also be indicated.

SECTION 7

Is the enquiry for a flange to flange unit? If not all the ancilliary equipment which is required should be stated. It may be felt that the responsibility is with the supplier to define the equipment required for a successful installation. In this case it must be clearly spelt out that it is the supplier responsibility. If this line of approach is taken it is absolutely essential that the client carries out a thorough adjudication of all bids to ensure that tenders are judged on a comparable basis.

SECTION 8

Estimating the erection requirements of a project at the tender stage is probably the most difficult and imprecise area of a proposal.

The more information that can be given will assist in minimising risk for all the parties concerned.

SECTION 9

Available utilities are self-explanatory.

SECTION 10

Terms of payment, conditions of contract, escalation and other contractual requirements should be highlighted.

Ultimately the final order can be won or lost on variations in the contractual terms and conditions suppliers are prepared to accept, to simplify adjudication these should be standardised.

BID EVALUATION

Having issued a good enquiry and specification and received a number of quotations it is vital that these tenders are adjudicated in a realistic way.

The industry supplying gas cleaning equipment has found, especially during difficult economic times, that many clients do not carry out a full evaluation of the tenders and end up simply buying the system with the lowest initial cost. We do not believe that this is done with any improper motive, we believe that initial capital cost has the greatest impact on the buying office.

Obviously it will be established that all Contractors have quoted on the same scope of supply, terms and conditions of contract and that all guarantees and programme requirements can be met.

When all these are met and it is checked that the equipment can fit into the required space and that the contractor has prior experience in the application it is then necessary to carry out an economic evaluation.

TENDER 1

Type of collector:	Electrostatic precipitator
Process gas temperature:	1 050°C
Cooler type:	Evaporative
Cooler outlet temperature:	300°C
Gas volume to collector:	46,90 Nm^3/sec wet 113,0 Am^3/sec
Dust loading at inlet:	19,5 g/Nm^3 wet
Collector efficiency (generated):	99,74%
Dust loading at outlet:	50 mg/Nm^3 wet
Pressure drop of collector:	20 mm w.g.
Fan static pressure:	120 mm w.g.
Fan motor installed power:	320 kW
Fan motor absorbed power:	250 kW
Transformer/Rectifier power:	200 kW
Ancillary motors:	21 kW
Cooling water power:	70 kW
Water consumption:	50 000 ℓ/h
Casing plate thickness:	5 mm mild steel
Design pressure:	300 mm w.g.
Weights – Cooling tower:	72 t
Precipitator casing:	107 t
Interior:	269 t
Support:	27 t
Cost – subject to escalation:	R2 845 000

TENDER 2

Type of collector:	Wet venturi scrubber
Process gas temperature:	1 050°C
Cooler type:	Wet scrubber
Cooler outlet temperature:	68°C
Gas volume to collector:	27,5 Nm^3/sec (dry) 80,4 Am^3/sec
Dust loading at inlet:	19,5 g/Nm^3 wet
Collector efficiency (generated):	99,74%
Dust loading at outlet:	50 mg/Nm^3 wet
Pressure drop of collector:	1 200 mm w.g.
Fan static pressure:	1 400 mm w.g.
Fan motor installed power:	1 900 kW
Fan motor absorbed power:	1 580 kW
Scrubbing pump power:	140 kW
Water consumption:	160 000 ℓ/h
Casing plate thickness:	5 mm mild steel
Design pressure:	1 500 mm w.g.
Weights – Casing:	75 t
Refractory:	55 t
Support steelwork:	15 t
Cost – subject to escalation:	R1 250 000
Exclusions:	Effluent treatment

TENDER 3

Type of collector:	Bag filter
Cooler type:	Water cooled duct/radiant cooler
Cooler outlet temperature:	200°C
Gas volume to collector:	75,3 Am^3/sec
Dust loading at inlet:	30 g/Nm^3 dry
Efficiency:	99,99%
Dust loading required at outlet:	100 mg/Nm^3 dry
Pressure drop across collector:	150 mm w.g.
Pressure drop across cooler:	150 mm w.g.
Fan static pressure:	400 mm w.g.
Fan motor installed power:	500 kW
Fan motor absorbed power:	430 kW
Ancillary motors:	40 kW
Compressor requirement:	25 kW
Water consumption:	10 000 ℓ/h
Casing plate thickness:	5 mm mild steel
Design pressure:	250 mm w.g.
Weights – Casing:	96 t
Cooler:	120 t
Support steelwork:	55 t
Cost – subject to escalation:	R2 660 950

APPENDIX 1

PROPOSAL DATA LIST FOR DUST COLLECTORS

Date: .... Purchaser's Enquiry Number: ....

1. General Information:

1.1 Purchaser ....

Address ....

Telephone Number .... Telex Number ....

1.1.1 User (if different from above) ....

Address ....

1.2 Site location ....

1.3 Individual, title and address ....

1.3.1 To whom proposal is to be sent ....

1.3.2 To whom technical queries are to be addressed ....

1.3.3 To whom commercial queries are to be addressed ....

1.3.4 Number of copies of proposal ....

1.4 Date by which proposal is to be submitted ....

1.5 Purpose of proposal: budgetary or firm? ....

1.6 Is formal proposal required, or priced letter? ....

1.7 When would order be placed? ....

1.8 Equipment delivery requirement date ....

....

1.9 Proposal basis (mark boxes):

Ex works ☐ delivered to site ☐ with erection ☐ F.O.B. ☐ C.I.F. ☐

Other ....

2. Plant Process

2.1 Process to which dust collector will be applied ....

....

....

2.1.1 Design data of dust producing equipment ....

2.1.2 Type ....

2.1.3 Make ....

2.1.4 Output: Continuous rating .... Peak rating ....

2.1.5 If process cyclic give details ....

2.2 Description and analyses of material or fuel ....

....

2.3 Expected variations in raw materials or fuel ....

....

2.4 Description and rating of existing collector equipment, if any . . . .

. . . .

3. Operating Conditions

3.1 Gas volume to be treated . . . . m^3/h

3.1.1 Continuous rating, actual m^3/h . . . . at . . . . ^oC . . . . =kPa . . . .

3.1.2 Peak rating, actual m^3/h . . . . at . . . . ^oC . . . . =kPa . . . .

3.1.3 Volume on which dust collector performance is to be based, continuous or peak . . . .

. . . .

3.2 Gas analysis and density . . . .

3.2.1 Moisture content in gas . . . . %by volume or . . . . %by . . . .

3.3 Nature of dust to be collected (include specific gravity, bulk density with two values, one for volumetric capacity of dust hopper and the other for structural design) . . . .

. . . .

3.3.1 Is dust known to have any unusual characteristics (hygroscopic, pyrophoric, explosive, sticky, etc.) . . . .

. . . .

3.3.2 Is a representative sample of dust available? Yes/No . . . .

3.4 Particle size analysis (State method) . . . .

. . . .

3.5 Dust concentration, g/nM^3 dry/wet . . . .

3.5.1 Continuous rating, g/Nm^3 dry/wet . . . .

3.5.2 Peak rating, g/Nm^3 dry/wet . . . .

3.5.3 Condition on which collector performance is to be based continuous or peak or cyclic . . . .

. . . .

3.5.4 Barometric pressure or elevation at plant site . . . . kPa or m

3.6 Is plant to be operated single/double shift or other schedule? . . . .

3.7 Maximum permissible pressure drop through equipment to be offered by supplier, kPa . . . .

. . . .

3.8 Other operating conditions . . . .

4. Required Performance

4.1 Collector efficiency . . . . per cent

4.2 Permissible emission . . . . mg/m^3 dry/wet

5. Layout Drawings

5.1 The dust collector should be installed generally in accordance with the attached drawing No. indicating any site restriction . . . .

5.2 Indicate single or multiple dust collector requirement . . . .

. . . .

(Note: mg/m^3 is to be understood as referring to milligrammes per cubic metre at 0^o Celsius at site ambient pressure.)

6. Design Features

The dust collector should have the following structural design features:

6.1 Operating pressure . . . . = kPa

6.2 Design pressure . . . . = kPa

6.3 Design temperature . . . . °C

6.4 Ground clearance to underside of dust discharger . . . . m

6.5 Hopper material . . . .

Minimum hopper valley angle . . . . from horizontal . . . .

6.7 Type of bottom: Hoppers (pyramidal, trough) drag scraper, wet or dry . . . .

6.8 Specific storage capacity . . . . hours

. . . . m^3

6.9 Wet scrubbers (where applicable)

6.9.1 Water flow – ℓ/s . . . .

6.9.2 Make-up water required – ℓ/s . . . .

6.9.3 Details of any additive required . . . .

7. Auxiliary Equipment

Auxiliary Equipment	By	Purchaser	Supplier

7.01 Supporting steel . . . .

Access facilities – ladders, platforms, etc. . . . .

7.03 Ductwork and expansion joints . . . .

7.04 Inlet and outlet mouthpieces . . . .

7.05 Dampers . . . .

7.06 Thermal insulation, cladding, weatherproofing, etc. . . . .

7.07 Hopper dust valves and conveyors . . . .

7.08 Pumps and effluent treatment plant . . . .

7.09 Fans and auxiliaries . . . .

7.10 LV and MV wiring . . . .

7.11 Instrumentation . . . .

7.12 Control room . . . .

7.13 Compressor and auxiliaries . . . .

7.14 Dust conditioning . . . .

7.15 Painting . . . .

7.16 Other . . . .

8. Erection Scope

8.1 Erection by purchaser or supplier . . . .

8.2 Erection supervisor services: separate quote or include in basic price . . . .

. . . .

8.3 Commissioning engineer services: separate quote or include in basic price . . . .

. . . .