CHAPTER 5

Handling Design Documentation

Documents and drawings are products of an engineering consultant, similar to cars that are products of an automobile manufacturer. Therefore, quality assurance (QA) and quality control (QC) measures shall be implemented in their production. Chapter “Balancing Between Client and Task Force Engineers” described some of the QA measures, like engineering team member qualifications from both the client and consultant point of view, working conditions such as salary, office space, human relations, etc. These are QA measures to ensure that the engineering team has the potential to generate documents with necessary quality. This Chapter describes further QA measures to ensure generated documents have necessary harmony and conformity with each other. In addition to that, QC measures to ensure issued documents match project requirements are described. Different from the car manufacturer is that we normally don’t do destructive tests and that documents are not mass produced.

Strict regulations shall govern document production and distribution. The intention is to ensure that documents will satisfy project requirements, will follow standard regulations, are as per normal engineering practice, don’t have ambiguities/internal contradictions, are constructible, and after installation and commissioning will deliver intended hydrocarbon volume. These procedures shall govern QA and QC steps:

**QA steps:**
- Document technical quality
- Document completeness
- Conformity to other documents
- Checking steps

**QC steps:**
- Numbering system
- Typing format
- Document distribution
- Archiving

Bullet points 1—4 are covered in the responsible discipline. Bullet points 5 and 6 are covered in the document numbering procedure and may change from project to project based on client requirements. Bullet points
7 and 8 also depend on project requirements but at the same time are affected by consultant practice and are taken care of in the document control center (DCC).

The author tried to present material in this chapter in a flow chart format but it showed no specific advantage. Text format may seem a little boring. It has to be emphasized that list numbering used in different sections doesn’t mean priority or less importance. It doesn’t mean if a step is not finished don’t proceed to the next. Each item can be individually checked or performed.

5.1 MASTER DOCUMENT REGISTER

Document preparation, issue, and progress check is controlled by a tool called: master document register (MDR). Preparing, updating and continuous monitoring of the MDR is a very valuable tool in achieving the previous goals.

Preparing the MDR doesn’t require sophisticated software or procedures. In its simplest form it may be prepared by software-generating worksheets. Automated systems have been developed that are very helpful. But even a simple table may serve the purpose. MDR is the main list including necessary information for each and every document/drawing that is (or shall be) prepared by the engineering group. Throughout the engineering project’s duration MDR is a live document and will only be closed in the final dossier report.

Some large consultants have developed engineering document management systems that can handle any document from start of production in an engineering discipline to end of approval by client. This system has the capability of assigning different access levels for each document to different users. It has the ability to prepare all necessary reports like time spent on this document by a specific user, progress stage, final status, prerequisite and trailing activities, etc. This wide range of information is necessary for the project team as well as other departments like financial, business development, human resources, etc. In this book I will emphasize only the simple and basic method of using a worksheet database.

A sample MDR format is attached in Table 5.1. Only a portion of one page is given. As a minimum it shall include following information:

- Document number and title
- Document type, class, and weight in discipline and project
Table 5.1 Sample page of master document register

<table>
<thead>
<tr>
<th>No.</th>
<th>Document Number</th>
<th>Document Title</th>
<th>Doc. type</th>
<th>Doc. Class</th>
<th>Doc. WF %</th>
<th>Planning Category</th>
<th>IFC/IFI/IFB Date</th>
<th>TR No.</th>
<th>Endorse by CA Date</th>
<th>TR No.</th>
<th>IFP/IFB Date</th>
<th>TR No.</th>
<th>AFC R. Letter No.</th>
<th>Client Response</th>
<th>Final Date</th>
<th>St.</th>
<th>Delay</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GEN-ST-DW-4566</td>
<td>Decks Structural Design Loading Diagram</td>
<td>DWG</td>
<td>2</td>
<td>0.008%</td>
<td>Planned</td>
<td>12-Apr-08</td>
<td></td>
<td>24-May-08</td>
<td></td>
<td>21-Jun-08</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>GEN-ST-DW-4567</td>
<td>Structural Perspective View</td>
<td>DWG</td>
<td>3</td>
<td>0.274%</td>
<td>Planned</td>
<td>4-May-08</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td>0</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>GEN-ST-DW-4568</td>
<td>Cellar Deck Primary Framing Plan (El. +11500)</td>
<td>DWG</td>
<td>1</td>
<td>0.365%</td>
<td>Planned</td>
<td>20-Feb-08</td>
<td></td>
<td>9-Apr-08</td>
<td></td>
<td>7-May-08</td>
<td></td>
<td>IFC</td>
<td>LT-1052</td>
<td>10-May-08</td>
<td>C</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>GEN-ST-DW-4569</td>
<td>Cellar Deck Secondary Framing Plan (El. +11500)</td>
<td>DWG</td>
<td>2</td>
<td>0.274%</td>
<td>Planned</td>
<td>29-Jul-08</td>
<td></td>
<td>9-Sep-08</td>
<td></td>
<td>7-Oct-08</td>
<td></td>
<td>IFC</td>
<td>LT-1139</td>
<td>26-May-08</td>
<td>C</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>GEN-ST-DW-4570</td>
<td>Lower Deck Primary Framing Plan (El. +16500)</td>
<td>DWG</td>
<td>1</td>
<td>0.366%</td>
<td>Planned</td>
<td>20-Feb-08</td>
<td></td>
<td>9-Apr-08</td>
<td></td>
<td>7-May-08</td>
<td></td>
<td>IFC</td>
<td>LT-2393</td>
<td>10-May-08</td>
<td>C</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>GEN-ST-DW-4571</td>
<td>Lower Deck Secondary Framing Plan (El. +16500)</td>
<td>DWG</td>
<td>2</td>
<td>0.274%</td>
<td>Planned</td>
<td>29-Jul-08</td>
<td></td>
<td>9-Sep-08</td>
<td></td>
<td>7-Oct-08</td>
<td></td>
<td>IFC</td>
<td>LT-1559</td>
<td>26-May-08</td>
<td>C</td>
<td>9</td>
</tr>
<tr>
<td>7</td>
<td>GEN-ST-DW-4572</td>
<td>Main Deck Primary Framing Plan (El. +25500)</td>
<td>DWG</td>
<td>1</td>
<td>0.365%</td>
<td>Planned</td>
<td>20-Feb-08</td>
<td></td>
<td>9-Apr-08</td>
<td></td>
<td>7-May-08</td>
<td></td>
<td>IFC</td>
<td>LT-2309</td>
<td>10-May-08</td>
<td>C</td>
<td>7</td>
</tr>
</tbody>
</table>
• Planned, forecast, and actual issue dates in each stage like: issued for comment (IFC), issued for approval (IFA), and approved for construction (AFC)
• Summary of client response history
• Delays and achieved progress

As per each contract and consultant normal operating procedures, document register configuration and format may change. These items are described in more detail in the following section.

5.1.1 Document Register Contents

Contents of the document register may vary based on consultant internal procedures and/or project-specific requirements. Besides, a consultant may prepare one register for its internal usage and one for inclusion in the weekly reports and issuing to the client. The degree of information included in each of them may vary based on consultant policy.

Each MDR may include one or two worksheets or be presented in different files with internal links to ensure uniform data are presented in all files. This is easily possible with defining necessary access for different departments. Since different parts of this information may be used for different purposes in the same organization, they may require stand-alone files. This will enable each department to process input information and extract necessary data or reports for management decisions. The major usage is by project team members. MDR shall include:

• Number of documents in each discipline and each category
• Document number and title
• Document type and class
• Discipline weight in engineering team
• Document weight in discipline and in total list
• Planned/actual start date
• Allocated man-hours (only for internal use)
• Actual consumed man-hours (only for internal use)
• Responsible engineer (only for internal use)
• Prerequisite documents (only for internal use)
• Planned/actual interdisciplinary check (IDC) date
• Planned/actual issued for comment date
• Planned/actual issued for approval date
• Planned/actual approved for construction date
• Latest issue information and last revision number
• Tracing transmittals number and date in each stage
• Client/engineering, procurement, construction, installation, and commissioning (EPCIC) contractor and third party authority (TPA) commenting/approval status
• Achieved progress

Information presented in MDR may be used by several parties including discipline engineers, lead engineers (LEs), project manager (PM), and even client. This is in addition to other departments within the consultancy like financial, human resources, etc.

For example, the financial department may want to know at a certain stage how much progress has actually been approved by the client. This means the expected cash in value. Subtracting actual received invoices from approved progress or invoices will give them an idea of how much further money for a specific period can be expected from this project.

Similarly, human resources may want to know if the assigned manpower to this project matches requirements. Do they need to recruit more engineers? Can they transfer some of the team members to other task forces?

The business development department may want to know if the estimates made in this bid match with actual personnel productivity. What unforeseen factors have arisen during project execution? What contingencies were extra or too low and need reevaluation?

These are some of the questions that departments other than project team members may need. There are many more questions and usages of MDR for other departments.

Some information shall not be disclosed to members out of the engineering team. For example, the engineering team may have a different document issue plan than the one issued to the client. The internal plan is normally stricter. This is only for internal usage. Issuing it to client will increase team responsibility and may be misused. In this case different files can be generated with interlinks to ensure confidential information is not disclosed to all while conformity is preserved.

Each engineer shall know at least the following:
• What documents are assigned to him/her?
• What timetable shall be followed in generating documents?
• What are the allocated man-hours?
• What prerequisite documents should have been prepared?
• What next-stage activities depend on his document preparation?
• What is the latest status of his documents?
5.1.2 Number of Documents in Each Discipline

Some may think this is trivial information, but it is not. It has to be highlighted that client PM and consultant managing director (MD) don’t have and don’t put in much time to review the registers in detail to be informed of the actual project progress. In fact, what they may need is only a one-page table showing the number of documents in each discipline, those issued as IFC, IFA, and AFC and the number of approved documents in each stage. This will give them a first-glance impression of the project progress (engineering status) and that is a major part of what they need.

For the lead engineers and PM this information (although useful) may not be sufficient. They need to go into further detailing. Introducing hyperlinks in the MDR list will help them easily find client comments, consultant response(s) and whether they are closed or still need further clarification. It is emphasized that even for lead engineers and PMs this table provides an important first-glance status of the project progress. A sample report of this type is given in Table 5.2.

The progress calculation in this table is based on assuming 60% progress for IFC, 80% for IFA, and 100% for AFC issue. These figures may vary based on contractual requirements. To simplify calculations, the total number of documents issued in each category will be multiplied by the difference of the related stage with the next. For the previous case it is 60% for IFC, 20% for IFA, and 20% for AFC. Weights are multiplied by the total number of documents in that stage and then simply summed up. It is understood that some contracts may assign different progress values for document issue stages.

In one summation approach discipline weight is taken as equal to the number of its documents divided by total documents. For example, process weight may be taken equal to 82 divided by 1182, which is 6.94%. Since out of 82 documents a total of 74 have been issued in IFC, 68 in IFA, and 55 in AFC, the progress weight in the discipline is equal to $(74 \times 0.6 + 68 \times 0.2 + 55 \times 0.2)/82 = 84.1\%$. This means that the process inside itself has about 84% progress.

This approach may not be so accurate. It doesn’t take into account physical weight of each document and discipline. Man-hours spent for documents vary considerably. To prepare some documents expert engineers shall use sophisticated software to generate necessary data/information. The better approach may be to calculate weighted man-hours based on consumed man-hours of each category of the engineering team.
<table>
<thead>
<tr>
<th>Discipline</th>
<th>Total</th>
<th>Started</th>
<th>IDC</th>
<th>IFC Issued</th>
<th>IFC Comment</th>
<th>IFA Issued</th>
<th>IFA Comment</th>
<th>AFC Issued</th>
<th>AFC Comment</th>
<th>Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>10</td>
<td>8</td>
<td>-</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>6</td>
<td>4</td>
<td>1</td>
<td>72%</td>
</tr>
<tr>
<td>Process</td>
<td>82</td>
<td>80</td>
<td>78</td>
<td>74</td>
<td>70</td>
<td>68</td>
<td>60</td>
<td>55</td>
<td>40</td>
<td>84%</td>
</tr>
<tr>
<td>Safety</td>
<td>45</td>
<td>43</td>
<td>40</td>
<td>38</td>
<td>30</td>
<td>28</td>
<td>20</td>
<td>18</td>
<td>5</td>
<td>71%</td>
</tr>
<tr>
<td>Mechanical</td>
<td>110</td>
<td>90</td>
<td>85</td>
<td>80</td>
<td>50</td>
<td>65</td>
<td>35</td>
<td>35</td>
<td>15</td>
<td>62%</td>
</tr>
<tr>
<td>HVAC</td>
<td>25</td>
<td>17</td>
<td>14</td>
<td>12</td>
<td>5</td>
<td>9</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>36%</td>
</tr>
<tr>
<td>Piping</td>
<td>125</td>
<td>100</td>
<td>90</td>
<td>80</td>
<td>40</td>
<td>60</td>
<td>20</td>
<td>15</td>
<td>5</td>
<td>50%</td>
</tr>
<tr>
<td>Electrical</td>
<td>90</td>
<td>75</td>
<td>70</td>
<td>60</td>
<td>35</td>
<td>43</td>
<td>22</td>
<td>25</td>
<td>8</td>
<td>55%</td>
</tr>
<tr>
<td>Instrument/Control</td>
<td>180</td>
<td>100</td>
<td>90</td>
<td>75</td>
<td>52</td>
<td>58</td>
<td>34</td>
<td>45</td>
<td>15</td>
<td>36%</td>
</tr>
<tr>
<td>Telecommunication</td>
<td>25</td>
<td>18</td>
<td>14</td>
<td>12</td>
<td>6</td>
<td>10</td>
<td>2</td>
<td>5</td>
<td>0</td>
<td>41%</td>
</tr>
<tr>
<td>Structural</td>
<td>450</td>
<td>250</td>
<td>-</td>
<td>240</td>
<td>150</td>
<td>180</td>
<td>60</td>
<td>110</td>
<td>40</td>
<td>45%</td>
</tr>
<tr>
<td>Architectural</td>
<td>40</td>
<td>25</td>
<td>-</td>
<td>20</td>
<td>11</td>
<td>14</td>
<td>3</td>
<td>8</td>
<td>3</td>
<td>41%</td>
</tr>
<tr>
<td>Sum</td>
<td>1182</td>
<td>806</td>
<td>481</td>
<td>699</td>
<td>457</td>
<td>543</td>
<td>263</td>
<td>320</td>
<td>132</td>
<td>50%</td>
</tr>
</tbody>
</table>
This will inform the lead engineers and PM how many senior and junior engineers or modeling/drafting or DCC staff may be needed.

To calculate project progress, individual discipline progress is multiplied by discipline weight and the total results summed up. Assuming all documents have the same weight, other disciplines’ weight and total progress will be as per Table 5.3.

This is not necessarily a correct approach but is used here for easy illustration and calculation.

Documents’ weights/importance are not equal. They are calculated based on the required man-hours in each specialist category to complete them. This is important both in payment from client and in checking necessary man power. Differences between invoicing progress and physical progress (actual weight) are defined in this section and Section 5.1.11.

Project progress is obtained by multiplying each discipline’s achieved progress to its weight in total engineering. In some projects clients may require to assign a weight for management. This way they want to ensure receiving required reports to the end of the project. In other projects weight may be assigned to documents like correspondence/numbering/progress measurement procedures and weekly/monthly progress reports. In other projects these documents may be issued once (even before kickoff meeting; KOM) with no weight factor.

In addition they may assign a specific weight factor for vendor data review/implementation or issuing final dossier documents. This way they

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Total</th>
<th>Progress</th>
<th>Discipline weight</th>
<th>Discipline progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>10</td>
<td>72%</td>
<td>0.85</td>
<td>0.61</td>
</tr>
<tr>
<td>Process</td>
<td>82</td>
<td>84%</td>
<td>6.94</td>
<td>5.84</td>
</tr>
<tr>
<td>Safety</td>
<td>45</td>
<td>71%</td>
<td>3.81</td>
<td>2.71</td>
</tr>
<tr>
<td>Mechanical</td>
<td>110</td>
<td>62%</td>
<td>9.31</td>
<td>5.75</td>
</tr>
<tr>
<td>HVAC</td>
<td>25</td>
<td>36%</td>
<td>2.12</td>
<td>0.76</td>
</tr>
<tr>
<td>Piping</td>
<td>125</td>
<td>50%</td>
<td>10.58</td>
<td>5.33</td>
</tr>
<tr>
<td>Electrical</td>
<td>90</td>
<td>55%</td>
<td>7.61</td>
<td>4.20</td>
</tr>
<tr>
<td>Instrument/Control</td>
<td>180</td>
<td>36%</td>
<td>15.23</td>
<td>5.55</td>
</tr>
<tr>
<td>Telecommunication</td>
<td>25</td>
<td>41%</td>
<td>2.12</td>
<td>0.86</td>
</tr>
<tr>
<td>Structural</td>
<td>450</td>
<td>45%</td>
<td>38.07</td>
<td>17.09</td>
</tr>
<tr>
<td>Architectural</td>
<td>40</td>
<td>41%</td>
<td>3.38</td>
<td>1.39</td>
</tr>
<tr>
<td>Sum</td>
<td>1182</td>
<td>0.50</td>
<td>100.00</td>
<td>50.08</td>
</tr>
</tbody>
</table>
can assign a fixed amount of project lumped sum cost for these activities. Consultants shall accept this only if a mechanism is envisaged to ensure necessary vendor data (which are issued by EPCIC contractor and consultant has no authority on their delivery) arrive on time. If vendor data schedule is not certain and client insists on assigning a certain portion of project to them, then suitable compensation measures for delay in submitting vendor documents to the consultant shall be foreseen. For each case, planning discipline and PM shall adopt the report format to project requirements.

Actual discipline weight is the number of total man-hours in different categories multiplied by respective unit rates. The same will apply to document weight. Therefore, the actual invoicing progress calculation for Table 5.3 may vary. Of course the difference will almost always be less than 10%. With that approach, columns 3, 4, and 5 will have different values.

As an example, assume the lead engineer unit rate is 60 $/h, senior 45 $/h, engineer 30 $/h, and drafting is 15 $/h. If the design basis document requires 30 h lead engineer and 60 h senior engineer, and 40 h engineer time it will weight $5700. Assume a drawing will take only 5 h LE, 10 h SE, 40 h EN, and 75 h drafting time. This weight is $3075. Both documents consume 130 h. But design basis weights 1.85 times more.

In addition as explained later and since design basis is issued at an early stage of the project, engineering manager (EM) shall consider its weight at least 20—25% more than actual calculated weight, which gives it 2.2—2.4 times more weight than this drawing if it is issued at a later stage. This is to ensure that small progress at the start of project (first nearly flat section of S-curve) can yield suitable progress for invoicing to improve consultant cash flow. Some EPCIC contractors understand this logic and accept it. Others may think pushing consultants as hard as possible will help them have a better grip on the project. The previous information shall be specifically hidden from this type of client.

The two issues of actual weight and importance shall be clearly distinguished. Document weight calculation was previously explained. It is a quantitative method. Document importance depends on the observer. EPCIC contractor, consultant EM, and project engineers have different evaluations of document importance.

- For EPCIC contractor a document is important if it can be directly used for procurement of packages, purchase of bulk items, or construction. For them, material takeoff (MTO), material requisition (MR), or fabrication drawings are the most important ones.
• For consultant executive manager documents having highest weight (largest progress/invoice) are the most important ones.
• For engineering team members documents that open the road to generation of other documents are the most important. In this way design basis and philosophies are the most important documents.

As explained herein, the EM can artificially increase weight of documents generated at the start of the project. However, their weight may not be sufficient to compensate for total costs. Therefore, he may assign a group of drafting and junior engineers to develop and issue typical detail documents that are more or less constant and applicable to different projects. These two policies and receiving advance payment help consultant cash flow at project start.

5.1.3 Document Number and Title

Each project will have its own “Document Numbering Procedure.” Since the client may have several projects in different locations and want to identify them easily (or simply because they want to adapt to their archiving system), the numbering system is normally determined by the client. However, in some cases the consultant may be free to use his own system. Some consultants insist on having their own numbering system printed on the documents even if the client has given a specific system. This causes some additional work and may sometimes lead to mistakes.

Document number may consist of several characters or digits. It may show oil or gas field location, project location, platform designation (if there are several platforms), discipline name that issues document, document type, a serial number for its identification, and revision number. A combination of alphanumeric characters may be used. In some cases it may be as long as 16 characters or more.

The main issue is that each document shall be identified by a unique designation. In some cases the client wants a combination of total characters and numbers to be unique and in some cases they may want only the serial numerical digits to be unique. All are possible without any problem. Only the search engine and archiving software shall be able to identify separate documents easily.

Document title is usually left to consultant selection. They are determined by discipline engineers’ experience and are fairly constant. Title shall reflect what contents can be found inside a document. Data sheets and specifications have a fairly constant name. Only the package name shall appear after document type.
5.1.4 Document Type and Class

Document type only shows what is expected to be seen in the text, whether it is a design basis, calculation sheet/note, analysis report, study report, philosophy, block diagram (BD), single line drawing, heat and material balance, instrumentation, material takeoff, list, drawing, specification, data sheet, main/secondary/tertiary framing drawing, equipment layout/general arrangement (GA) drawings, cable route, escape routes, material requisition, technical bid evaluation, etc. Each discipline may have its own categories of document types, but inside a project within different disciplines it is better to use uniform abbreviations for the same type documents. For example, every discipline has a design basis. Different names may be used like basis of design, design basis, or design premise. It is better in a document register for a specific project to make it uniform. However, this is not a mandatory requirement.

A list of different document types in process discipline and their proposed abbreviations follow:

- Basis of Design, Process-sizing Criteria (DB)
- Platform Operation Philosophy (PH)
- Mass, Heat and Utility Balances (report and calculation files) (HMB)
- Process Flow Diagrams (PFD)
- Utility Flow Diagrams (UFD)
- Process and Instrumentation Diagrams (PID)
- Process Data Sheets for Equipment, Instruments, Systems, Packages, Vessels (DS)
- Process Design Calculations (CAL)
- Relief System Calculations, including Flare Network Hydraulic and Blowdown Calculations (CAL)
- Cause-and-Effect Charts, Safe Chart (CH)
- Chemicals Characteristics and Consumption List (LI)
- Process Data Sheets for Control Valves, Safety Valves, BDVs (DS)
- Emergency Shut Down Philosophy (PH)
- Hydraulic Calculations (CAL)
- Main Process Line Sizing (CAL)
- Main Utility Line Sizing (CAL)
- Vendor/Subcontractor Data/Drawings/Calculation Notes Review (VD)

Some documents may be general documents that although generated during an engineering project may not be listed in the MDR. They are not directly related to project technical subjects. These documents may be listed
under a general topic. Documents like MDR format, Document Numbering Procedure, Project Correspondence Procedure, Project Quality Plan, Progress Measurement Procedure, etc. are listed under this category. Some clients don’t want to pay individually for these documents because they are not directly used for procurement or fabrication purposes. Therefore they include some of them under project management discipline and calculate the progress based on total project progress. Others may be categorized under different discipline titles.

The reason is these documents can/will be prepared even before actual project start. Therefore, client shall pay progress for them while they can’t be directly used for procurement or fabrication. Therefore, the client prefers not to pay for them unless other “useful” documents are issued. By “useful” (from client point of view) I mean documents that are directly used for procurement and or construction of the project.

Document class shows its approval rank. Normally three ranks are identified.
- Approval Class
- Review Class
- Information Class

Document class is selected based on its importance for Client. For example, PIDs are classed under “Approval.” They define equipment capacity, rating, operating/design temperature and pressure. In addition they provide information on piping material, line classes, change in piping/equipment specification, sectionalization, and control and monitoring instruments on the package or on the piping. Although some of this information like equipment power consumption is transferred from other disciplines and documents, PID is a document that is more than others referred to and therefore plays a central role. For this reason clients always categorize it as “Approval Class.” They want to implement their comments on this document before taking any action toward procurement.

The difference between document class and issue status shall be clearly understood. The definition explained next may not be universal but has been used in many projects.

Normally, for documents/drawings under “Approval Class” the consultant/EPCIC contractor shall wait to receive client comment/approval on the issued document at a certain stage and then proceed to the next stage. For those under “Review Class” they may proceed after certain duration has elapsed even if client comment is not received. For “Information Class” they
may proceed without waiting for client comments. The normal time limit for commenting is 14 calendar days. In spite of this definition, in almost all contracts the client keeps the right to comment any time on any document. If it was an engineering mistake then the consultant shall rectify it at his own cost at any stage of the job and even during the guarantee period. In some cases client comment may only be a personal preference and not standard minimum requirement or contractual obligation. In spite of this, almost always the consultant will find it very difficult (if not impossible) not to implement client comment (issued long after contractual period) and convince them to keep the issued revision.

In almost all contracts clients put in a sentence that stipulates “client approval on any document doesn’t relieve consultant of its responsibility.” In essence this only refers to engineering mistakes. However, in a majority of cases clients misuse it to enforce implementing their comments in the latest issued document.

The other importance of document class is in defining invoicing progress milestones. Normally the first issue of approval category is IFC, the second IFA, and the third AFC. For review category this is IFR and AFC. For the information category the first issue is considered to be IFI. Normal weight for IFC is 60%, IFA/IFR is 80%, and AFC/IFI is 100%. Again, I repeat that these weights may change as per contract.

5.1.5 Document Weight in Discipline

Each lead engineer shall prepare his/her own estimate of the man-hours required for complete preparation of a document. These man-hours shall include man-hours consumed by discipline manager, lead engineer, senior/junior engineers, designer, drafting, and specialist study. The man-hours shall include all required time for the following stages:

- Preparation, distribution, and review of the hard copies and required goby documents for all relevant personnel in the discipline
- Preparing the draft analysis model/study report, etc.
- Review of prepared draft model/report by a senior engineer
- Performing analysis and preparing the report
- Discipline internal check/review by checker
- Revisiting model/report for touch-ups as per discipline internal check
- IDC/review
- Revisiting model/report for comments received from other disciplines
- Issuing in IFC stage
• Interface with client in responding to comments
• Revisiting model/report to implement received comments by client, TPA, and others.
• Review by the checker
• Issuing IFA stage document
• Interface/meeting with client for second or other rounds of comments (if any)
• Interface with other disciplines for hazard identification (HAZID), hazard and operability (HAZOP), model review, and vendor data impact, whichever is/are applicable.
• Issuing documents in AFC stage
• Design review and clash check man-hours
• Possible reissue(s) in AFC stage
• Final issue in final dossier stage

It is evident that lead engineers don’t have and can’t calculate separate assigned man-hours for each document and each stage listed herein. They will only provide a general estimate, which based on previous experience may cover above time-consuming factors. Individual time sheets are a valuable source to define relatively accurate man-hours for different documents and disciplines.

At the start of the project each lead engineer distributes the required documents for performing discipline assignments between the task force engineers. This single point responsibility (SPR) concept shall be strictly adhered to Ref. [38]. Each document shall be assigned to one person. He/she may receive help from others in the same discipline or outside. But he/she shall be responsible to circulate for internal comments as necessary, implement them, and issue as per project time schedule.

Normally the time sheets in engineering offices is not so detailed to enable department managers assign a specific figure for each of these activities. Even if time sheets were so detailed the engineers couldn’t accurately differentiate man-hours consumed for each of these stages. Therefore usefulness of such detailed time sheets is under question. Of course its existence is better than not. However, drastic change in consultant well-established procedures may not be so yielding at least for the first few projects. Normally man-hours consumed for each document are only tentatively known. In some consultancies engineers only fill the time sheet separating projects, not the documents. It is the planning department that based on the number of involved engineers and the weekly plans and achievements issued by lead engineers calculates the general consumed man-hours.
It is not possible to give an accurate figure for each of the items listed previously. However, the lead engineer shall keep titles of applicable man-hour consumption stages in mind, not to underestimate the required time for each document. The department manager or lead engineer estimates on each document a number for man-hours consumed and then multiplies a contingency factor to account for other interfaces.

As explained, some documents are more important for client/EPCIC contractor. For example, data sheets and specifications are used to get a vendor quotation for procurement. For long-lead items this may be a necessity to overcome some of the project schedule bottlenecks. Structural MTO and drawings are used in construction yard activities. This is the first yard activity. Sometimes clients define milestones for issuing these documents. This is a two-sided blade. The advantage is that issuing them at an early stage helps the project time schedule. The disadvantage is that issuing them earlier than the time that all necessary data are available introduces an uncertainty/inaccuracy factor on their adequacy. EPCIC contractor and consultant shall be aware of involved risk. Even if issued MTOs may change in the final dossier it is the consultant’s obligation to keep changes within acceptable margins so that additional procurement is not required or will not adversely impact the project schedule.

The PM has to add some margins for contingencies and any unprecedented events. The lead engineer may apply contingency factors to each single document, the department manager may apply contingency on total discipline summation, and the PM shall apply contingency on the total project summation.

Company overhead factors shall also be added by EM. Detailed descriptions of factors affecting overhead factor are defined in chapter “Proposal Preparation.”

### 5.1.6 Document Stage Action Dates

Dates of document action stages are needed for two reasons:

- Planning department to check progress as per plan and highlight delays to lead engineers
- Invoicing team to calculate achieved progress

For planning group date of starting, issued for IDC, issued for comment, issued for approval, and approved for construction dates are important.

For the invoicing group only contractual milestones that lead to payment are important. In some contracts the client accepts stage-wise
payment for start and IDC and in some they don’t accept. Physical progress of each document is different from its invoicing progress. It is normally agreed that in IFC stage almost 60% of the job is completed. The remaining 40% may be divided between the other two stages. However, each contract shall be reviewed separately. In some projects client agrees to calculate progress for AFC equal to 100% and then deduct some certain value and release it after issuance of final dossier. In some projects client may only deduct the good performance guarantee.

PM and lead discipline engineers are very anxious about accomplishments of dates as per plan. Some documents may be delayed in the project course at any one of these stages. This may be due to several factors like:

- The estimated man-hours were less than actually required.
- The engineer assigned to this job is not competent enough.
- Client introduces certain queries/comments that need further investigation and additional studies.
- Some uncontrollable events happen such as the assigned engineer resigns and it takes some time for the newly assigned engineer to become familiar with the job.

In some cases two plans may be prepared. One plan is issued for the client and the other one is kept for internal usage. The internal plan always has earlier dates for each document. From another point of view these may be considered as early and late plans for the same project. The late plan will be issued to the client and the early plan kept for internal usage and progress calculation.

In defining the late plan overtime shall not be considered. In this manner possible delays can be covered with several days’ overtime.

Normally 5—10% behind planned progress (delay) may be acceptable. This may be the difference between early and late plans. If it increases beyond this limit, lead engineers and PM shall prepare a catch-up plan. Therefore every week the progress report shall be carefully reviewed by them. Client also may issue warning letters and ask for catch-up plan.

Lead engineer shall only think of how to remedy delayed time and whether it affects next-stage documents. PM shall not only think of remedial actions but also shall see if the delay is caused due to client faults. In that case he has to prepare proper claims. Backup documentation to support claims is very important and is prepared from the planning team report.
Normally clients are very reluctant to accept they are the cause of a delay. But to be honest, a majority of delays are due to client action. The client enjoys a very powerful position without so much responsibility. In a majority of cases even after proving they have caused delay, the consultant has to undertake to rectify the status with its own man power and expect no compensation. The client only issues responses to enable consultants to finish the job.

If a client team is fully mobilized at early stages of the project and has competent engineers then they may contribute to the project progress. However, if their team comes late and insists on commenting on all documents even if they were issued much earlier this will have a disastrous effect on the schedule. Meticulous engineers from both sides may cause problems to project progress. In a majority of cases, instead of closing documents with a focus on major items, they request so many unnecessary details, reports and insist on their own understanding that the only way for the consultant lead engineer to get rid of them is to implement comments without further arguments.

5.1.7 Allocated Source, Budget, and Achieved Progress

As mentioned previously, invoicing progress may be different from physical progress. Other than PM and lead engineers normally no one is interested in physical progress. However, there are certain norms that are widely accepted. For example, when a document is issued in IFC stage, 60% progress is assigned to it. At this milestone invoicing and physical progress become the same. It means if at a certain date all documents are issued simultaneously at IFC stage and no other activity is taking place, then invoicing and physical progress are both equal to 60%. But between these stages, although the project team may have achieved progress (greater physical progress), it is not calculated by the client (less invoicing progress).

This time lag between achieving invoicing progress, issuing related invoice, approval by client, and actual payment is a buffer safety zone for the client, who is always sure they have received more work than paid for. At the same time this delay has a negative impact on consultant cash flow. To be fair, I have to admit part of this is compensated for with advance payment.

There is one important point here that has to be emphasized. In each project there is a gap between the reported invoicing progress by the
project team and the accepted progress by the client. This is if the client is fair. A majority of clients don’t even bother to tell consultants what is the acceptable progress and why some parts have been crossed. Only to withhold payments (with a contractual reason) to have more power in possible disagreements with consultants do they systematically deduct some progress rates. This is in addition to their contractual right of paying approved invoices with certain delay. In fact in every contract the client keeps a few days (up to 2 weeks) for progress approval and then some additional time (may be up to 1 month) for payment. The only safeguard that the consultant has is the advance payment (AP). Before instructing AP payment, client receives a bank guarantee for it. Normally bank guarantee conditions are very strict and client can confiscate them any time without necessity of a court verdict.

Unfortunately in none of the projects that the author was involved were either of these two dates followed. Delays of up to several months have been seen in actual payment compared to actual progress. In addition, some of the EPCIC contractors are stingy toward consultants and generous to vendors. Therefore it is a good practice (and in many cases necessary mitigation measure) to manually/artificially add weight of documents that are issued at early stages of the project. This provides a small help to consultant cash flow.

As an example, design basis and philosophies are issued at early stages (maybe the first one-fourth span) of each project. The author recommends increasing their weight at least by 20—25%. This has several impacts.

- Normally project progress curve is a flat S shape at beginning. This means in a specific time duration at early and late stages of the job, less progress is achieved compared to the same time span at the middle of the project schedule. In the middle of the schedule the progress rate is higher. Increasing weight of design basis and philosophies helps to increase the early slope of the S-curve. Seeing the higher weight discipline LE is encouraged to issue them at early stages of the job to get more progress, while keeping a suitable man-hour margin in the physical progress.
- At the early stages of the project client/EPCIC contractor time is less occupied. Therefore, they can comment on these major technical documents. This means consultant can upgrade them to AFC and use them in related documents as prerequisite.
• These documents are affecting other documents in the related discipline. Therefore receiving comments at early stages of the project and responding to them helps to get them finalized and open the path for other related documents like specifications, data sheets, analysis, etc.

The next-stage documents after design basis and philosophies are specifications, data sheets, and analysis reports. These are the basis for material requisitions and fabrication drawings. It is recommended to increase the weight of these documents as well. The rate of increase and selection of documents is to be done by PM. Lead engineers shall keep away from this practice. It may leave a negative impact on their evaluation of the project and lead to erroneous measurements of project actual progress. LE shall use actual physical progress.

Although PM shall always keep a close eye on invoicing progress, LEs are normally concerned only with physical progress. A certain number of engineers and man-hours are allocated to each LE. He/she has to finish the project with that budget. Almost in all projects actual consumed man-hours will exceed first allocated man-hours. PM and discipline head of department will always keep some reserve man-hours and release permit to use it after careful investigation of the situation.

5.1.8 Document Status

Each document’s status shall be clearly known. In some projects construction activities may continue parallel to engineering. Therefore upgrading a document to AFC stage shall be carefully monitored. In some contracts clients don’t care for the actual status of the document. With each new issue the revision number and consequently the status will raise one stage. However, in some other projects unless the consultant is certain of document quality and status they will reissue it at present status with a higher revision number. By quality only the engineering work is not meant. Receiving and implementing all concerned parties’ comments, implementing interface impacts, reviews and implementing vendor data impact all have an effect on quality.

Upgrading document stage to AFC after ensuring all parties’ comments have been implemented and vendor data impact has been foreseen helps to prevent rework in the construction yard. Almost in all projects EPCIC contractor can’t wait for as-built vendor data to start fabrication.

From the payment point of view the second approach is not to the consultant’s benefit. Besides due to high costs that EPCIC contractor may
have in standby condition, they also need to start as soon as possible with available information. In the course of project progress some rework or additional purchases may be beneficial in total project cost savings. The unfortunate point is that although a majority of EPCIC contractors know the advantage of these small reworks they may misuse it against consultants.

Document status includes its stage and commenting status. Several parties may be involved. Client, EPCIC contractor, TPA, MWS, etc. all may be involved on a particular document. Although normally in all contracts it is written that consolidated comments of all concerned parties are to be issued simultaneously, seldom (if ever) does this materialize. Therefore consultants shall keep track of their comments that have been taken care and closed. This delay list is a helpful tool against client claims for document delay, although it may never lead to additional payment for consultant rework.

5.1.9 Who Shall Prepare the Document Register?

The document register shall be prepared by lead engineers of the related disciplines. In its preparation he or she may use their own personal experience or use the consultant data base prepared from employees’ worksheets or get advice from other senior engineers in the department.

Lead engineer shall assign each document to a specific engineer. He or she shall strictly follow the single-point responsibility (SPR) rule. Each document shall only have one assigned engineer. The assignee may use other sources’ information in IDC stage. In the IDC matrix it shall become clear which documents are to be distributed to whom and when. The responsible engineer shall check the received IDC responses to ensure received information is complete.

5.1.10 Who Shall Update the Document Register?

The document register is continuously monitored by the planning department. Each week they issue a report to the PM highlighting documents that are behind schedule. Some of the delays may be attributed to the client. However there are some delays that are due to underestimating man–hours required for preparing a document or some other reasons that at that time couldn’t be properly managed to avoid delay.

Based on the mutual agreement between lead engineer and PM the plan for the document register can be updated. It is important to note updating is
not a weekly job. The revised plan shall be used as the basis for progress
calculation. Each time the first plan remains unchanged only the revised
plan or forecast changes. The actual progress is calculated based on the
actual document issue dates.

Internally both early and late progress shall be calculated. If there is no
contractual requirement, it is strictly recommended to report only the late
plan to the client.

5.1.11 Progress Status Evaluation

Two types of progress are defined. They are invoicing and physical
progress. The first one is important for clients and is used as the basis for
payments. The second one is important for lead engineers and EMs.

During bid stage EM receives (from LEs) estimated man–hours in each
discipline distributed to lead, senior, junior, etc. categories. Each one has a
specific unit rate. Multiplying unit rates to man–hours and adding
contingencies each discipline weight in the project proposal is obtained. At
bid stage a detailed MDR is not prepared. Instead shares of different
document groups are determined. For example, design basis and philoso-
phies get 10%, specifications get 20%, data sheets get 25%, calculations get
15%, main drawings get 15%, and others get the remaining 15%. Based on
agreements at KOM a detailed MDR will be presented with weights
assigned to each document. Since MDR is a live document, during project
progress it is possible to add or delete some documents. Normally it is
preferred that additions or deletions don’t impact previous invoicing
progress calculations/payments. Therefore, either the weight will be
deducted from unissued documents or zero weight will be assigned to
them.

There is some time delay between issuing a document (ie, obtaining
actual progress) to a client for review of progress appraisal to actual
payment. If everything goes smoothly a document that is issued during a
month (even on the first day) will be invoiced at the end of the month.
Assuming documents are uniformly generated throughout the month
(on average) its progress is claimed with 2 weeks’ delay. Client review will
also take at least 2 weeks. After this stage consultants are allowed to in-
voice. Normal routine in client financial department and bank money
transfer will take at least 1 month. This means that even if everything
proceeds smoothly, actual payment will be received with at least a
2-month delay.
To overcome this delay and reduce its impact, two mechanisms may be foreseen. The first is AP. Clients accept to pay 10–20\% of project value against an acceptable bank guarantee. With each progress invoice client deducts pro rata portion. For example, in invoice 10 if progress is 65\% they will deduct 65\% of AP value from invoice payment.

AP payment alone is not enough to cover large staff payments at the start of the project. EM shall consider higher weight for documents that will be issued at an early stage of the project. For example, if design basis and philosophies that will be issued at an early stage of the project are calculated to have 15\% weight, they will be assigned 18–21\% weight. Weight of specifications and data sheets are also increased but similar reductions will be made on remaining documents like drawings, MTOs, etc.

Physical progress is not needed by clients. But it is very essential for LE and EM. This may be calculated only considering man-hours without multiplying by unit rates. At each stage LE knows how many man-hours have been consumed and how much budget remains. It is to the consultant’s benefit if compared to invoicing progress the physical progress is less. This shall not be misinterpreted. It doesn’t mean fewer documents are issued than those accepted by the client. It means documents are issued with better efficiency than originally planned. This way the project team is able to invoice 100\% when there are still some budget man-hours left from the original estimate. Physical progress is intended for internal use and shall not be disclosed to client team members. They will think the consultant is cheating them to invoice higher while their physical progress is less. This is not cheating. The difference is in higher unit rates for lead and senior engineers, which are above average project unit rate.

5.1.12 Catch-up Plans

Catch-up plans are needed to cater for delays incurred on the project schedule. In very rare cases in which client accepts their responsibility or when they instruct a change request, a catch-up plan may only include an extension of the engineering plan. In this case the same task force may be able to achieve this goal. In many cases discipline engineers shall accelerate document issuance by either working overtime, adding a number of involved personnel, replacing some members of the present task force with more qualified engineers, etc.
As a rule of thumb, PM/lead engineer shall monitor each discipline’s progress on a weekly basis and initiate catch-up plan if delays become more than 10%.

At early and middle stages of project, PM and LEs will check progress on a weekly basis. At end stages PM may check progress in biweekly steps, but LEs shall continuously check it in weekly steps.

### 5.2 INTERDISCIPLINARY CHECKS/DISCIPLINE INTERFACES

The main item that distinguishes a team from individuals is the meetings and interfaces that they have with each other. This covers both technical and human interfaces, which should be extended to engineering and client team members. In some cases client engineers may find themselves in a situation separated from others. This isolated feeling is not positive. The author thinks very positively of human interfaces; however, this section is dealing with preplanned technical interfaces.

It will be an exceptional job to create feelings of a unified team between client/consultant team members. The author has in few cases succeeded in achieving this goal. This way in addition to getting salary, engineers enjoy working on this project. Two engineers working as good team members add to each other’s capabilities and cover weak points. They may produce 2.5 unit results. Two engineers working as bad team members decrease each other’s productivity. They may produce 1.5 unit results consuming the same man-hours.

#### 5.2.1 Identifying IDC Checks (IDC Matrix)

For multidisciplinary projects it is essential to have comments from all involved disciplines. At the start of each project and after preparing each discipline MDR, a general meeting between lead engineers has to be performed by PM (EM). In the meeting each LE will mark documents from other disciplines that he or she wants to review/comment on and at the same time mark documents from his/her discipline on which they want other disciplines to comment. The extent of commenting may vary from checking or inputting a few interface items to completing sections assigned to that discipline. IDC matrix shall be discussed mutually to achieve a general agreement.

An example is given for package data sheets. In some projects each discipline like mechanical, process, electrical, etc. prepares a separate data
sheet for each package. In order to issue that package MR, all data sheets have to receive comments from client and either implement or respond to them and upgrade to a suitable level to be included in MR. Based on the author’s experience this is very difficult to manage if data sheets are issued separately by each discipline.

Consider a pump that may require process, electrical, piping, mechanical, instrument, and structural information to be completely defined. Some of the information to be defined by each discipline includes:

- Process shall determine design, operating pressure/temperature, discharge rate, suction, and discharge line sizes.
- Electrical shall determine power consumption including voltage/current intensity, cable sizes, feeders, and protection rating.
- Instrument shall determine controlling signals like start, stop, running, and fault detection, whether they are transferred to integrated control and safety system or unit control panel.
- Piping shall determine material of construction and pipe specifications.
- Mechanical shall determine pump type and other mechanical specifications like continuous or intermittent operation.
- Structural shall determine supporting conditions and accelerations experienced in different installation, transportation, and operation stages.

These are at least six different disciplines. Some of the information comprises only a few words or figures. Some others may need extensive descriptions. Minimum document status to be included in MR is IFA. If each discipline issues necessary information separately, this makes six documents to be issued at least twice. Client comments shall be received, reviewed, and either implemented or responded to at both stages. The solution is to issue only one data sheet by the discipline that is responsible to procure that package. Rotary equipment is normally included in mechanical discipline responsibility. During IDC related sections in a consolidated data sheet will be filled in by each discipline. Ultimately before issuing with MR only one document needs to be issued twice. This is more manageable.

In addition to this case, many other documents shall be reviewed and interface data filled in or comments affecting them to be reviewed and agreed to by both originator and the related discipline. IDC check requirement for same type of document in different disciplines is not constant. For example, process design basis shall at least be reviewed by mechanical, electrical, instrument, and piping, while structural design basis
may only need to be reviewed internally. Packages’ specifications prepared by mechanical discipline shall be reviewed by others like process, electrical, and instrument. Table 5.4 shows a typical IDC matrix.

This table shows seven process documents that are part of their philosophies, calculations, reports, and specifications. As is clear, the certifying authority (CA) has requested to review all except one. Process itself is the discipline responsible for generating these documents. Safety has requested to review three, mechanical five, piping five, electrical one, instrument four, and structure has not requested to review any document. This table can be agreed on at the first stage of the project and if needed revisited during project progress. As one of the QC steps in issuing a document, DCC will use this file to check if all IDC steps have been completed before issuing that document.

5.2.2 Dedicated Time/Priority

Normally all disciplines face man power shortages. When commenting on IDC documents each discipline has their own shortcomings. Therefore it is natural to give priority to their related discipline documents. This may be acceptable for 1 or 2 days. But more than that will have cascading delay impact. Therefore in the IDC transmittal each discipline shall mark the return date. Before return date an alarm date may be specified. This will help DCC to check document status. In case response is delayed, the related discipline shall be immediately notified to assign an engineer urgently to perform and release the job.

Similar to the delay list on issuing documents DCC shall prepare delay list in commenting on IDC documents. To avoid cascading delay impact, PM shall closely check this list and expedite required documents.

5.2.3 Weekly Meetings

Weekly meeting is an essential tool in project coordination. In addition to general meetings, private discussions with each discipline shall also be conducted. The following issues may be discussed:

- Each discipline’s delay and mitigation measures to prevent further delay/remedial action
- Delayed IDC documents and related catch-up plan
- Client commenting status and its impact on project progress
- Cascading impact of delays (from all sides) on remaining documents
- Information circulation/interface between disciplines
- General issues that all disciplines shall follow
<table>
<thead>
<tr>
<th>No</th>
<th>Doc number</th>
<th>Document title</th>
<th>Doc type</th>
<th>Class</th>
<th>CA</th>
<th>PR</th>
<th>SA</th>
<th>ME</th>
<th>PI</th>
<th>EL</th>
<th>IN</th>
<th>ST</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NOR-GEN-PR-DB-3900</td>
<td>Process design basis</td>
<td>DB</td>
<td>1</td>
<td>y</td>
<td>y</td>
<td>y</td>
<td>y</td>
<td>y</td>
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<td>y</td>
</tr>
<tr>
<td>2</td>
<td>NOR-GEN-PR-RO-3901</td>
<td>General philosophy for isolation, shutdown and draining</td>
<td>RPT</td>
<td>1</td>
<td>y</td>
<td>y</td>
<td>y</td>
<td>y</td>
<td>y</td>
<td>y</td>
<td>y</td>
<td>y</td>
</tr>
<tr>
<td>3</td>
<td>NOR-GEN-PR-CS-3902</td>
<td>Process and utility line sizing calculation</td>
<td>CAL</td>
<td>2</td>
<td>y</td>
<td>-</td>
<td>-</td>
<td>y</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>NOR-GEN-PR-SP-3903</td>
<td>Water treatment system—duty specification</td>
<td>SPC</td>
<td>2</td>
<td>-</td>
<td>y</td>
<td>-</td>
<td>y</td>
<td>y</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td>5</td>
<td>NOR-GEN-PR-SP-3904</td>
<td>HP/LP flare TIP process specification</td>
<td>SPC</td>
<td>2</td>
<td>y</td>
<td>-</td>
<td>y</td>
<td>-</td>
<td>y</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>NOR-GEN-PR-PR-3905</td>
<td>Emergency shutdown and depressurization philosophy</td>
<td>PHL</td>
<td>2</td>
<td>y</td>
<td>y</td>
<td>y</td>
<td>y</td>
<td>y</td>
<td>y</td>
<td>y</td>
<td>y</td>
</tr>
<tr>
<td>7</td>
<td>NOR-GEN-PR-RO-3906</td>
<td>Flare, blowdown and depressurization calculations and report</td>
<td>RPT</td>
<td>2</td>
<td>y</td>
<td>-</td>
<td>y</td>
<td>y</td>
<td>y</td>
<td>-</td>
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<td>-</td>
</tr>
</tbody>
</table>
Meeting schedule shall not be rigid. Otherwise it may waste time. Some issues that shall be observed in planning each meeting may include:

- At early stages of the project weekly meetings may be necessary. Later the schedule may need to change. Biweekly and even monthly meetings are recommended at later stages of the project.

- The first stage of each meeting may be dedicated to a review of agreements in the previous meeting and completion status of each agreement.

- Meeting agenda shall be distributed in advance to allow participants to gather required response.

- Ad hoc meetings may be arranged when necessary. Normally they may cover only one or two subjects.

- It is advisable to group meeting agenda in several subtopics. The first will be “general” to cover issues all or majority of disciplines shall know. Issues related only to certain disciplines may be discussed individually or the related discipline may be allowed to leave the meeting after closing their issues.

### 5.3 DOCUMENT CONTROL CENTER

The document control center is the main control center for document handling/distribution in each engineering team. Documents and information flow to and from engineering team is directed by this group. Normally DCC staff are from secretarial and clerk levels. Very clear and established procedures shall be defined to avoid mistakes in document flow. This team shall perform a number of tasks. The following list shall be adapted to each consultant and project requirements. Some of these items may be transferred to the planning department. In a majority of cases for a specific project, planning and project control team can be stationed within DCC staff as part of the task force assigned to the project. Some of the tasks listed following may not be required as per contract terms.

DCC tasks may be listed in three categories: administration and QC; document handling; and document control.

#### 5.3.1 Administrative and Quality Control

Tasks under the administration and QC category include activities needed to ensure documents are issued as per approved project format. If consultant has a dedicated department to cover all administrative tasks, they may be handled elsewhere. However, in a majority of projects DCC team may
undertake all secretarial work and coordination needed by the project. The major items are listed herein:

1. Review of document’s format to follow project quality system: Normally this activity may be only a glance through the document. At the start of each project document’s/drawing’s format will be prepared and distributed to all disciplines. This includes cover page, tabulation page, table of contents, introductory paragraphs’ text, and other pages’ logo and format. Format may extend from page margins to font size, line spacing, indents, definition of headings, etc. In some projects client may dictate its own preference, and in others consultant may use their usual format. After distributing approved formats, all engineering team members shall follow the same procedure.

2. Coordination with client for their possible trips to reserve hotels, book tickets, transportation, meals, etc.: This is necessary in case client and consultant are at different locations. Normally client team members (especially high-ranking managers) expect a specific level of courtesy. Regardless of cost or consumed time they expect the consultant to treat them with respect as VIP. This is neither illegitimate nor wrong.

3. Coordination for engineering team members for travel and meetings with client, EPCIC contractor, yard fabricator, vendors, etc.

4. Coordination with engineering subcontractors (if any) for general meetings like design review, HAZOP, etc. to book tickets, transportation, reserve hotels, meals, etc. For example HAZOP chairman shall be out of the engineering team. It is not cost-effective to recruit specialist study engineers on a permanent basis. Normally their services are hired for a specific task. Chairman or specialist may be stationed for a short duration in consultant office. Cost-wise it is efficient to devote their entire time for the assigned task. Even if their contract is on lump sum basis, it will save on the total cost to help them in these trivial matters with an office staff.

5.3.2 Document Handling

Project document handling is the main task for the DCC. This task covers a wide range of activities. Following, the list numbering continues from the previous section.

5. Establishing project filing system (including hard and soft copies) and continuously updating it: Consultant tendency is toward paperless office. Well-established office network with clearly defined access
routes is a real necessity. Client access to information shall be as per contract. For more safety it is even possible to physically separate networks. This may require additional effort in document uploading and increased costs in hardware installation. Software for document management is available. The author, however, has no experience with them. All their capabilities can be incorporated in a well-defined office system. Main capabilities of these document management systems include:

- They make it possible to assign different access levels to individual documents per user.
- They prepare a report of working time on each document by connected users. This is used in project control and may later be used in estimating man-hours required for each document during bidding.
- In addition they enable document issuing after release permit by predefined authorized user is granted.
- They can assign schedule to each document, which helps in planning and project control.
- They prevent excessive printing and help to move toward paperless office.

Hard copy archiving requires a lot of space. After each new revision old ones shall be transferred to a discard archive and kept only for the sake of history. Of course all correspondence including comments, responses, minutes of meetings (MOMs), actions shall be kept in a traceable manner. Any time in a project a newcomer may open a long time ago disputed and closed issue. Especially if he is from client team he expects to receive a response with full backup documents.

6. Set up and revise access level for different participants to project data base: This may include different levels of access for PM, LE, engineering team, and client team. In some cases to avoid mistakes different servers or physically separated networks may be used for different teams. Normally each engineer prepares assigned documents in his or her own computer or in the dedicated section of server. Then he shares it with the checker or LE for approval. In each discipline only LE has access to all native files and issued documents of that discipline. PM also has access to all disciplines. Only DCC has the responsibility and therefore the ability to remove or copy a file to the assigned section. Others may only have “read” access to other disciplines’ documents. It is even better to transfer required documents between disciplines through DCC personnel. To have a clear line of responsibility it is recommended to
assign someone for interaction with DCC in each discipline and give cut-and-paste authority only to one of DCC’s personnel.

7. Corresponding with client to ensure documents are downloadable after transferring them in soft copy format (via e-mail, or Internet to download from an FTP site): In certain cases the Internet access may impose some difficulties. This problem is in third-world countries. Internet access speed is continuously increasing. This correspondence ensures that the client has received required documents. Immediately after uploading, client shall be informed that certain documents are available for access.

8. Scanning and uploading issued documents on the server and if required on the Website: Some documents may contain several hundred pages of A3 or A4 size papers. Some may have been printed on both sides of paper. Some pages may not be legible or may have been put in the wrong direction or page number order. Before scanning, all these issues shall be reviewed very quickly. With automatic high-speed, high-resolution scanners the above checks will produce fast and neat results. Almost all software now has the ability to directly print to imaging files (like PDFs). The produced document is searchable, is smaller, and is clearer. However, since it can be altered, normally it is avoided and scanning is done from hard print. Security limitations can also be installed on the files. This depends on the contract. One solution is to send one set of hard copy in addition to the image file from software.

9. Preparing/issuing necessary transmittals and correspondences to client: All correspondence with client including letters, MOMs, engineering documents, invoices, change requests and orders, technical queries, etc. shall pass through DCC. For some, DCC has to prepare transmission document and for others shall only archive or list it. In any case it is DCC’s duty to ensure correspondence is received by the client. If an action/response is expected, DCC shall expedite to receive it.

10. Preparing necessary number of hard copy documents: Although gradually decreasing, even now a majority of clients prefer to receive a necessary number of hard copies from consultants. Commenting on soft copies still has some restrictions. This will reduce client headaches on preparing additional copies and distributing. In project peak progress normally some documents are issued daily. Later they may reduce the number of documents per week. In some projects parts of engineering activity may have been subcontracted. This means specialist
staff may be stationed in a separate building. Some specialist studies like HAZOP or computational fluid dynamics (CFD) studies are of this category. Although in a majority of projects client members may be stationed in the engineering of finance, they may insist to deliver a certain number of copies to their main office. Each project will have a printing policy that shall be followed by DCC. This is specially recommended if personnel handling different projects are stationed in the same department.

11. Dispatching printed documents to client on a daily/weekly basis as per contract requirement: DCC shall find a procedure to receive a receipt for each transmission. Even for electronic transmissions a read receipt can be obtained and shall be archived.

12. Coordinating with client and the dispatch organization to make sure documents are received and signed transmittals are returned/archived for future reference: This is specially required when a third-party organization out of consultant personnel is hired/contracted to perform this task.

13. Printing, faxing, scanning, and uploading project correspondence: As explained in item nine herein, all correspondence shall pass through DCC. Some of them, like invoices, need preparation of a certain number of original copies. They shall all be signed and stamped. While others, like letters, need only the PM’s signature. The contract defines the authorized representative signature for commercial and technical documents. Normally PM is the fully authorized representative.

14. Receiving client comments on project documents, listing them, and dispatching to discipline engineers: Client comments are the main issues that have to be discussed, responded to, and resolved. Accurate tracing considering comments themselves, their receiving dates, dispatching to discipline, and receiving response is a major necessity. In some contracts clients may insist to receive responses, discuss, and resolve them before the next-stage document is issued. This may be applicable for some main documents. Following the same procedure for all may take a long time.

15. Keeping track, expediting, and receiving consolidated discipline engineers’ reply to client comments on issued documents: This may vary from accepting, responding back with additional backup documents, to rejecting or accepting a compromise solution. DCC shall issue response letters/transmittals. In some projects client may instruct to receive a response sheet and close it before issuing the next revision
of a document. They may want to have a meeting to discuss/agree on the responses. This is only possible if client members are stationed at the same office. Meetings will consume considerable man-hours of a project’s budget, unless they agree on quick informal discussions. Too many meetings/discussions may also detract consultant engineers from their intended plan. On the other hand, if client intention is not fulfilled they may continue endless commenting. Therefore it is preferred to avoid this as a general approach for all documents if there is no contractual obligation. For some specific key documents like design basis, philosophies, main specifications, and data sheets, following this approach of closing comments in a meeting before issuing a revised document may be beneficial to all sides. Meeting agreements shall be carefully listed in MOM to know each party’s undertakings. In a majority of cases a meeting with no MOM will be forgotten by all, or at least majority of, attendants.

16. Uploading revised documents by discipline engineers onto the server: To avoid introducing viruses to the server and losing some documents, only DCC staff shall have write permission on the server. Other team members have only read permit. Inside DCC they may assign a single username or different usernames.

17. Preparing necessary transmittals to client: Based on contract requirements, consultant may need to issue documents to several users like EPCIC contractor main office, fabrication yard, commissioning subcontractor, installation subcontractor, company, third party, etc. Some of these recipients may not receive all documents. A distribution matrix shall be prepared at the beginning of the project to inform DCC staff who shall receive what.

18. Distributing copied documents: Normally clients will receive as many hard copies as needed but will only send one set of a hard copy. In general only the discipline that has prepared and is responsible for issuing a document shall receive comments on project documents. Vendor quotations and documents shall be distributed to several disciplines for review and comment. The discipline responsible for that package determines which other disciplines shall receive what portion. They may mark on the hard copy or the soft copy of transmittal. This will inform the DCC of the required number of hard copies or recipients of related e-mails. In each case DCC staff shall trace issued documents to enable them to receive responses on time and transfer them to the originating discipline.
19. Preparing transmittals and issuing client comments with consolidated discipline engineers’ response to third party for endorsement: This may not be required in all contracts. However, in some projects a third party may wish to know client comments on IFC documents for their own review. If possible, consultant shall not accept this term. The point is that the third party shall be independent and act unbiased. Their decision and approval shall be based on general engineering practice and applicable standards. Even if needed they can perform their own independent analysis.

5.3.3 Document Control

Parts of tasks listed under the document control topic are project control department tasks. Here it is assumed the project control engineer is stationed in the DCC office. To avoid duplicated effort, they are listed under DCC tasks. Assignment of tasks listed in Section 5.3 to different groups is no problem. Care shall be exercised that tasks required by the project are not neglected.

20. Prepare and update on a weekly basis the list of issued letters, correspondences, etc. showing what has been sent in which parcel, who has issued it, when it was issued, when the client received it, who in the client organization received it, if and when we expect to receive any response for that, keep track of its response, when has it been uploaded onto the Website, etc. This information is very vital for project control requirements. This shows why in some cases project control personnel are stationed in the DCC or have direct access to some of their documents and database.

21. Expediting discipline engineers for response to IDC documents, keeping track of interdisciplinary transmittals deadlines, and highlighting delays if any: As explained, each discipline gives priority to its own documents. Therefore IDC documents may wait in the queue or even be neglected. This may have adverse impact on other disciplines’ progress. Some documents (especially those directly used for procurement or fabrication) may have cascading impacts, causing delays on total project progress.

22. Updating discipline documents registered in cooperation with discipline lead engineers: Sometimes disciplines may have their own personnel for archiving and updating MDR and sometimes DCC personnel may do it for them. Especially if a company is using an early plan for internal usage and late plan for reporting to the client, both
shall be updated—the first one in LE computer and the second one in DCC server.

23. Keeping a list of project correspondence and their closing status on a weekly basis: Some of the letters may not need a direct response, but other correspondence like technical queries, invoices, change requests, and change orders require a clear response. At each stage the PM shall know which items still need expediting and which may impact project progress. It is important to note that some queries that need definite instruction may delay project documents. An accurate report not only helps to have fruitful meetings but also may be used later in claims and counterclaims.

24. Keeping track of documents issued for endorsement and highlighting if there is any delay: In some projects client may instruct another certifying authority (CA) to either endorse or approve consultant documents. CA will not review all documents. They may not even look at certain documents like MTOs, lists. However, some others like philosophies, basis of designs, PIDs, etc. will be carefully reviewed and commented upon. Client may also request to receive a copy of the CA comments and consultant responses. They may even prevent a document to be issued in AFC if CA is not satisfied with the responses. Closing CA concerns may play a major role in project progress.

25. Keeping track of issued documents to client for approval, commenting, and expediting on a weekly basis: In almost all projects in the contract it has been stipulated that any document not responded to within a certain period (normally 14 days) will be deemed approved. But again in a majority of projects the client has not followed this rule. They use a very well-known excuse (which is again stipulated in all contracts) that a technical fault shall be rectified any time. From the author’s experience, if out of 100 late client comments the consultant manages to prove 50 are only personal preference and not a technical requirement, he has had good luck! In many cases time and effort needed to justify this is more than the time required to redo the job. This report will be used in claiming against delays more to save the consultant from liquidated damages and not to receive compensation.

26. Keeping track of final AFC documents, preparing transmittals, and issuing to client: Before issuing AFC, consultant may add any number of changes. After that any change shall be carefully investigated. Normally the contractor is allowed to fabricate based on AFC drawings
unless some portions of it are HOLD. It is possible to upgrade a document/drawing in AFC but HOLD an entire sheet. It is clear that consultant shall have a proper reason to HOLD a document. Otherwise stopping the contractor will have considerable cost impact for yard man power and delay in project.

27. Keeping track of and listing document revision permits from different disciplines: This permit may be defined in the engineering execution procedure. LE or an authorized SE shall prepare it to allow the respective engineer working on a document to spend man-hours and upgrade it. This permit may contain brief information describing the reason for and the extent of revision. Majority of LEs don’t like this permit due to considerable paperwork. However, it is a very good source to prevent unimportant changes, to track implemented changes, and keep man-hours within budget.

28. Keeping track of project audit dates, findings, and remedial action status: Other than technical audits, HAZID, HAZOP, and design reviews there are certain nontechnical audits that only focus on the formats and checks if adapted procedures have been properly followed or not. These are defined in consultant quality plan. Audit results are consultant internal reports and need not be issued to client.

29. Updating list and revision number of issued documents with weekly report: Preparing detailed and accurate weekly report is an important task. It is to be done by project control department/group or representative. I have named all three to show it is possible for project control to be performed in a separate department. This may have the advantage that their reports are free from influence of PMs or discipline leader and can therefore evaluate project progress from an unbiased point of view. In addition their representative may be assigned as project task force and be directly connected to PM. Since PM is responsible to perform his tasks within approved man power and allocated time frame, he may use project control help to this benefit.

30. Keeping track of documents issued to yards and coordinating to receive list of documents necessary for their fabrication: This is part of EPCIC contractor DCC team. However, in some contracts they may not mobilize the necessary employees in their project team and instruct consultant to perform it on their behalf.

In this section many times we have referred to preparing a transmittal. Although it may have different formats, the information included is more or less similar. A transmittal is a covering page accompanying each
batch of documents issued to a receiver. It may contain the following information:
- Project name and number
- Name and logo of parties involved in project
- Name and reference number of the originator
- Name and reference of the receiver
- Document(s) title and number
- Document(s) revision number, status, and class
- Page size and total pages
  Each transmittal shall have a location for signature of the receiving body.

5.4 VENDOR DATA CONTROLLER

Vendor data controller (VDC) has almost the same function as DCC with respect to vendor data. There are some differences both in originating and handling of documents:
- Main difference is that related documents in DCC tasks are generated by engineering team and commented on by others, while in VDC tasks documents are generated by vendors and commented on by engineering team.
- As per engineering contract, consultant is responsible to rectify any engineering mistakes any time. Although normally client commenting cycle has a definite time limit, generally they continue commenting any time it suits them. In contrast, if consultant starts a new comment on vendor documents, they will claim delayed time.
- Before purchase order (PO), vendor may accept comments leading to changes in technical specifications. They will calculate its financial impact in their final quotation. Even if they ignore cost impact it may be a calculated action to improve their chance to win the tender. After PO vendor normally doesn’t accept any change without prior approval of its time/cost impact. In some cases in which they plan to introduce themselves in a new market or want to improve their reputation (expecting future contracts), vendors may ignore small cost impacts. In others they may use any small opportunity for a claim.
- DCC has direct communication with producers and recipients of documents while VDC normally receives documents from and passes comments to EPCIC contractor. There is no direct contact between consultant and vendor. This indirect contact is essential during vendor quotation review. The main intention is for consultant to concentrate
on technical issues and disregard commercial items. However, after PO direct contact to some extent may be preferable.

- In majority of documents distribution matrix defined for VDC and DCC is completely different. EPCIC contractor may not want some documents to be issued to client. Selected topics and number of required hard copies differ considerably in the two groups.

- Client/EPCIC contractor actions to project documents other than class category are more or less the same. While vendor documents during quotation evaluation/ technical bid evaluation (TBE), after placing, PO and final data book have different status. For example, client may not need to review comments on vendor quotations but requires reviewing comments on specific vendor documents after PO. However, EPCIC contractor is interested in all comments having time/cost impact.

- Engineering team action and consequently VDC action on vendor quotation and vendor data are different. Their format and extent also differ. In majority of MRs specific list is given for inclusion of necessary documents in quotation. This is intended to facilitate one round of clarification and possibility of comparison between different quotations. Some vendors don’t follow it. After PO majority of vendors follow approved supplier documentation requirements schedule (SDRS).

- VDC Transmittal format is completely different from DCC. It shall enable related disciplines to identify which part of quotation or vendor data shall be handed over to whom. Normally a table is placed at top of the transmittal. Below it all received documents are listed. The horizontal row of the table has numbers corresponding to the list below it. The vertical column of the table shows discipline representative names. The discipline responsible for that package shall receive a whole pack of documents. In this table and in front of other disciplines’ rows they mark the cells related to document numbers as given in the list.

An example is given in Table 5.5. Assume Oily Water Package vendor has issued five documents. Mechanical discipline is responsible for this package. Documents include:

1. Degassing skid GA drawing
2. Degassing vessel nozzle location and orientation
3. Degassing skid PID
4. Degassing skid control panel
5. Inspection and test plan (ITP)
As can be seen in Table 5.5, AR, SA, and TL are not interested in any issued documents. EL and ST only review one. QA/QC group is normally out of consultant team. IN and PI each review three documents. This pattern shall be clear for documents included in each transmittal.

It is understood that there are more similarities than differences between the tasks undertaken by each group. Main activities of archiving, expediting, checking, etc. remain the same.

In this section first different types of vendor data (after PO) are described, and then VDC action on their handling and progress control during quotation review and after PO are described.

### 5.4.1 Types of Vendor Data

Documents issued by vendors during bid stage are very different from those issued after PO. Documents issued by vendor after contract is assigned follow SDRS list. Of course vendor may not follow SDRS included in MR. It is mainly intended to serve as a sample and guideline. At first stage after PO, vendor will issue its own SDRS, which shall be discussed and agreed upon. Later a vendor document list will follow agreed SDRS.

Broadly, vendor data may be categorized in four types including contractual, technical engineering, QA/QC, and operational documents.

- **Contractual**
  These are documents that define manufacturer schedule (engineering, procurement, fabrication, testing, and dispatch), organization (man power, facilities/equipment, subcontractors), subvendors for raw material or package items, testing, progress measurement, delivery schedule, progress measurement procedures (physical, invoicing, weekly or monthly reports, areas of concern), etc.
• Technical Engineering
These are documents showing vendor design, tie-in flanges/interfaces with other platform equipment and utilities like compressed air system, sea water, fuel oil, blanketing gas, power system, consumption, general arrangement, technical catalogs, PIDs, BDs, control system, package engineering calculations like process, structural, piping, electrical, package 3D modeling (if applicable), data sheets, specifications, etc. In engineering documents vendor shall give calculations for package capacity, function, mechanical design, power consumption, performance, etc. In some cases vendor technical catalogs may be accepted. For proprietary items vendor may not give their design details. Instead, some certificates from third parties may be accepted.

• Manufacturing procedures
In these documents vendor needs to give relevant bending, welding, forming, painting, etc. procedures. The list shall be extensive enough to show vendor has completely understood the steps involved in manufacturing this package.

• Quality Assurance/Quality Control
These documents show vendor organization for quality management. QA documents may include procedures for material selection/procuring, performing engineering design, welder qualifications and evaluation, welding procedure qualification, equipment suitability, worker knowledge of the job, tools calibration, nondestructive tests, dimensional checking, quality plan, inspection test procedures, etc. QC reports may include material composition/mechanical property test reports, third-party certificates, nondestructive (or if applicable destructive) test reports on the selected specimens, ingress protection/hazardous classification test reports, parts or full package operation tests, etc.

• Operational and maintenance
These documents show vendor instructions for package handling, installation, operation, maintenance, and repair. Vendor shall give related procedures to enable safe and sound usage of supplied equipment by operators during platform life time.

Each group of documents may be needed by a certain party. For example, EPCIC contractor procurement department is interested in contractual documents. These documents allow them to check manufacturing status, arrange package testing, transport, and handover to yard personnel. Engineering team is interested in technical documents. This enables them to provide required utilities in the correct location and in
sufficient capacity. Client/EPCIC contractor QC team are interested in QA/QC procedures/reports. EPCIC contractor yard and client operators are interested in operational and maintenance documents. Therefore not only consultant but also EPCIC contractor and client shall comment on vendor documents. Regardless of who is commenting on what, vendor final dossier shall contain a complete package for future usage.

5.4.2 Vendor Data Handling

Similar to DCC, vendor data handling covers all stages from receiving a document to gathering consolidated comments and dispatching to EPCIC contractor. At each stage general status shall be clear. Before start of actual manufacturing, responsible discipline shall give “go ahead” signal for fabrication to vendor. This doesn’t mean that back-and-forth comments can continue endlessly. Other than teleconferences, face-to-face meetings with vendors may also be arranged. This shall exclude major events like KOM, HAZOP (if applicable), factory acceptance test (FAT), etc. VDC tasks from start of quotation review to final dossier can be listed as follows:

Quotation Stage

1. Establishing project filing system (including hard and soft copies) and continuously updating it: Quotations, technical queries, and vendor documents shall be archived in different locations. Responsible discipline shall have close cooperation with VDC to determine how shall documents be distributed. For example, assume a quotation includes GA, preliminary PID, and BD. Structural discipline may only need to review GA. PID and BD are not required for them. PID shall be distributed to process discipline. Piping may require both GA and PID. Instrument requires BD. If it is a vessel then electrical discipline may not want to comment on any part of this quotation or vendor data.

2. Receiving the quotations, listing their status, and dispatching to responsible discipline for technical clarification (TC): Expediting discipline engineers to issue TC may be in VDC or project control scope of work. VDC may keep quotations in its office and dispatch to discipline after sufficient number of quotations become available, or send to discipline to keep and maybe start a preliminary review if they find spare time. Later in this chapter a first-stage control checklist will be explained. First-stage checking may be done by a junior engineer to ensure
submitted quotations are complete. This will save senior engineers time. If anything is missing, they can inform EPCIC contractor to provide missing information.

3. Downloading vendor/client procurement responses to TCs, printing and issuing them to discipline engineers responsible for the package and distributing IDC transmittals: Vendor response may range from revising quotation, adding new data to it, changing parts of it as per requirements, providing backup documents, etc. Client may normally not interfere in TC stage. Only after issuing TBE they may comment on parts of it.

Although TBE and MR for purchase are related to procurement and vendor data activities, they are issued in DCC team. Only quotations and clarifications are kept in VDC.

After PO and at Vendor Data Review Stage

4. Coordinating with EPCIC contractor procurement department to issue the introduction letters: This may not be required in all projects. In some projects EPCIC contractor may accept or instruct consultant to directly contact vendors after issuing PO. Before TBE, communication with vendor is only through EPCIC contractor. After placing PO, package cost is fixed. Therefore to expedite information circulation, consultant may directly contact vendor. In this case EPCIC contractor procurement manager shall officially introduce consultant representative to vendor. In this introduction letter (which may be done in vendor KOM) contact points/representatives from each side and the extent of their authorities shall be clearly defined.

5. The first step in VDC is to receive vendor documents. VDC staff shall check if they are accompanied by a proper transmittal and are following project requirements. Quality of the document to enable engineers to review them like visibility of numbers, legible sketches, etc. shall be checked at this stage and remedial action taken before reproduction and distribution. VDC shall receive vendor data, download, and print them. If vendor data are transferred via e-mail or access to vendor FTP site, they shall print necessary numbers and pack if hard copy is received. A detailed list of received items shall be prepared to enable accurate tracking of the received data.

6. Comparing vendor data with their issued SDRS and sending expediting letters to vendors: VDC staff shall check received data with SDRS issued by vendor or document list attached as an appendix to
MR issued for purchase. Their issuing sequence, dates shall match vendor SDRS.

7. Vendor shall follow ISO requirements in issuing documents. Review of vendor documents format to ensure they follow project quality system is part of VDC tasks. Proper project format (logos, numbering, title, etc.) shall be used, revision numbers shall be correct, changes should have been clouded, response sheet should accompany issued documents, etc. It is very difficult to instruct vendors to change their document format. Normally the vendor engineering department is producing several documents for the same equipment for different projects. Other than small changes in logo, title, and project name they will not accept any other changes. They normally resist instructions for adding new sections to each document, performing new analysis or simulations.

8. Distribution of received vendor data to relevant disciplines (commissioning, yards, client, QA, etc.): VDC staff related to detail design engineering team are only concerned with discipline requests. However, VDC staff in EPCIC contractor team may need to dispatch related documents to others like commissioning team, yard engineering, and client. In some projects EPCIC contractor may request consultant to perform this task on behalf of their team.

9. Receiving engineering group comments on vendor documents: Detail design team shall check vendor data for two main reasons:
   - Engineering team shall ensure project specifications are exactly followed. If there is any deviation it shall be discussed and reviewed/approved properly. All deviations (minor/major like material of construction, utilized power, capacity, etc.) shall be highlighted to enable a proper decision.
   - Engineering team shall ensure all tie-in points are properly taken care of. For example, if there are any water, fuel, electrical power, instrument cable connections they should have been properly reviewed to have the exact location and value on the platform.

10. Preparing necessary transmittals and correspondences to EPCIC contractor/client with a complete list of commented documents (scanning, copying, uploading, and packing as necessary): This is to ensure vendor has received full response on time to avoid any delay in package manufacturing. Again transmittal format may be different from DCC. Logos, project title, etc. are similar. To avoid mistakes, different
numbering can also be used. For example, if DCC transmittals start from 1, VDC can start from 5000.

11. Scanning and uploading commented documents by engineering group on the server and if required on the Website: Normally documents uploaded on server are for internal LAN users and those on the Website are either for client or vendor downloading. In this case proper username and passwords with correct authorization should have been defined beforehand. They shall be revised as suits each project.

12. When documents are transferred in soft copy format (via e-mail, or Internet to download from FTP site) correspondence with client to ensure documents are downloadable and files are not damaged: In downloading vendor quotation or data, they shall be legible and printable. As explained before, correspondence channels may differ based on contract requirements. VDC may directly correspond with vendor to send a damaged file or ask EPCIC contractor representative to communicate and receive required file. If communication is indirect it is to the EPCIC contractor’s benefit to do this checking before transferring to consultant. This will save project time. The additional consumed man-hours in EPCIC contractor procurement or engineering office are much better than delay in fabrication yard.

13. Reproducing necessary number of hard copy documents: With paperless offices this may not be required. However, the originating discipline may want to keep one set of consolidated comments for easy access. They may prepare it themselves. It is too time-consuming to circulate one set of hard copy between all involved disciplines to write down their comments. All disciplines shall receive their assignments simultaneously. Only in this way can project deadlines be met.

14. Dispatching copied documents to client on a daily/weekly basis as per contract requirement: Although in distributing documents to disciplines, EPCIC contractor and vendor’s VDC may need to work much more than DCC, here the workload is normally much less.

15. Coordinating with EPCIC contractor, client, and the dispatch organization to make sure documents are received and signed transmittals are returned/archived for future reference: Importance of receipts in VDC may be more than DCC, because vendors tend to claim more if there is any delay. Although this may seem pessimistic, sometimes vendors plan a production time schedule with their present load factor. After a first contract they may receive others. For manufacturers it is very difficult, if not impossible, to immediately mobilize additional man power.
They will try to keep the original plan with overtime and even maybe some subcontracting, but at the same time they will try to find some legitimate excuses for delay on vendor data comments. Therefore, project control team and VDC shall be very careful on project deadlines.

16. Printing, faxing, scanning, and uploading project correspondence: Other than technical queries by vendors, which may need correspondence, normally VDC has less work in this category.

17. Scanning, preparing the transmittals, and uploading the engineering comments/clarifications to vendors or client procurement team: Again, in paperless offices comments may be given on the soft copy document. Document management systems provide this facility to enable engineers to directly give their comments on the soft copy. Other than saving the environment by preventing many hard copy printouts, this has a very good advantage in allowing all related parties to view others’ comments at the same time. Of course at any time only one person is able to comment and others will have read-only access.

5.4.3 Vendor Data Control

Controlling progress and status of vendor quotations and documents may have same importance as project documents. Parts of these activities may be assigned to project control team. However, information providing evaluation basis is generated in VDC. Therefore, similar to project documents, project control engineer can be stationed in VDC. Physically DCC and VDC may be stationed at the same office. In addition when vendor data starts, project document workload is reduced. Therefore the same project control engineer with the help of some VDC staff can undertake these tasks.

Quotation Stage

18. Keeping track of MRs issued to client procurement and expediting in issuing quotations: EPCIC contractors are very eager to receive long lead items MR at the first stages of the project. Long manufacturing duration, exotic material, sophisticated design, proprietary design, new technologies, etc. characterize long lead items. High-power turbo-generators and compressors, high-pressure pumps, dehydration and regeneration packages, Class 1500 and above ESD valves, etc. may fall in this category. In some projects client may decide to free issue them to save time. Even in this case vendor data review and matching the
input and output to project requirements will be done by consultant. EPCIC contractor shall also follow deadlines in submission of required quotations/vendor data. Engineering PM shall have a specific time limit. Delays in submitting quotations that exceed allowable values shall be documented and informed to EPCIC contractor PM. This letter will both act as a warning and later may be used as delay justification.

From another point of view as per engineering contract EPCIC contractor may have a certain deadline in obtaining the required number of quotations for engineering review. If quotations arrive late, their technical evaluation may not be possible within the expected time frame of the contract. Normally EPCIC contractors avoid issuing PO in favor of any vendor unless all technical issues are completed. This will cover complete scope of work as per MR and required package specifications. After receiving PO and gaining some manufacturing progress, vendors get the upper hand. They know EPCIC contractor is vulnerable to their requests. Therefore some of them may misuse this status to claim cost or time impact if they get any legitimate excuse for changes.

19. Keeping list of issued MRs and informing PM of delayed item(s) on weekly basis: Project control and VDC have no means to persuade discipline leaders to expedite issuing any document. They shall provide updated reports to PM to enable him to arrange necessary catch-up plans. This item is similar to the previous one with the difference that it was external to EPCIC contractor and this is internal to engineering disciplines.

20. Keeping track and expediting client procurement team to issue the TC/TBE starting letter: Issuing this letter again depends on contract conditions. Maybe after receiving a certain number of quotations consultant has to start automatically. Maybe client wants a specific time span to see if better quotations (cost/time-wise) could be obtained. It is to the consultant’s benefit to start evaluation of all bids in one package simultaneously. First of all this will save time. The engineer responsible for that package will work more efficiently if has all packages on the table. He can search for a specific topic on all quotations and comment on them equally. More important, since he is reviewing similar items at the same time his evaluation between different quotations will be fair. Again, if EPCIC contractor delays in issuing TC/TBE start instructions, and exceeds limits set by engineering team, they shall officially document it.
21. Issuing an early status report on received quotations: This may include an explanation whether they are complete according to MR checklist and compliance letter, whether they are from approved vendor list, whether they are suitable for technical clarification, and issuing TBE. This report needs responsible discipline engineering input. Based on this report, PM may issue a letter to EPCIC contractor and state that if on-time response is not issued, the quotation will be included in the TC and a conditional TBE may be issued or rejected.

22. Expediting discipline engineers for response to IDC vendor quotations/documents, keeping track of interdisciplinary transmittals deadline, and highlighting delays: Similar to project documents, disciplines have a tendency to give priority to their own packages. Continuous expediting will ensure no one has unintentionally forgotten a document in the rush of project workload.

23. Keeping track and expediting engineering group to issue TBE: TBE is an important project document that enables EPCIC contractor to prepare CBE. This is an important step in issuing MR for purchase and placing PO. TBE issue time shall be governed by project schedule. However, based on vendor response to a specific package some quotations may be clear and some others may need further clarification. Engineering PM shall coordinate with EPCIC contractor PM to find a solution. May be project procurement plan allows further correspondence with vendor, or they may ask consultant to issue a conditional TBE, or to expedite the job; a technical meeting is arranged between vendor and consultant to close the issue immediately.

24. Checking the issued TBEs and letters of acceptance with issued PO list: Each TBE shall lead to a PO, otherwise vendor data will not arrive. Vendor data review and implementation is an important part in completion of detail design. Vendors will not produce any data unless PO is issued in their favor and certain conditions like opening an effective LC, placing AP, etc. are fulfilled. Even after these prerequisites they need some time to develop documents to a certain extent to issue them. All these time constraints impact detail design time. Therefore, they shall continuously monitor PO status.

After PO and at Vendor Data Review Stage
At this stage it is assumed quotation review is finished and selected vendor has started to issue vendor data. Similar to any engineering project, at this stage vendor shall finalize related SDRS as first priority.
25. Issuing letters to vendors indicating issue dates of SDRS and deadlines: SDRS list and dates attached to MR for quotation is only indicative. Either during bid or during KOM, EPCIC contractor, vendor, and consultant may agree on certain list of documents and issue dates. It is understood that SDRS acts as vendor preliminary MDR. Therefore it may undergo some changes as per engineering progress. Consultant or EPCIC contractor in contact with vendors shall expedite them for producing related documents and highlight delays. Delays shall be carefully documented and expedited. Consultant has no leverage to enforce that vendor sends required documents. Therefore EPCIC contractor PM or procurement manager shall expedite vendors through means envisaged in PO. Placing PO is the honeymoon time. Sometimes during this joyful time both sides forget to put in necessary clauses to define mechanisms to expedite action from each side. In the absence of these mechanisms, continuous expediting will serve project goals.

26. Keeping track of vendor documents issued to responsible discipline for commenting and expediting on a weekly basis: Again this may be shared with project control group. As explained before, its importance may be more than project documents. This is basically a project control activity, but as explained for a single engineering project an independent project control group will not be assigned. In some cases consultant will assign someone to work under PM instruction or he or she will be stationed within VDC staff. When they issue an IDC transmittal he or she will immediately incorporate transmittal in the list and generate reports as per PM request.

27. Preparing the list and keeping track of expected reply date and expediting other disciplines’ engineers: Originator discipline may not be able to track issued documents and expedite other disciplines to respond on time. Present software can easily provide required warnings. Setting warnings for 1 or 2 days ahead of actual deadline may enable disciplines that have forgotten a specific document to respond to it on time.

28. Reporting the vendor documents’ status on a weekly basis: In this report VDC shall highlight concern points. They may include delays in receiving vendor data, mistakes in proper numbering, references, formats, quality of vendor data, etc. One general problem is that vendors may try to neglect consultant comments as much as possible. Or they don’t bother to follow ISO rules and cloud revision points, etc.
This report may even consider internal problems like delays in commenting on vendor data, new comments that had been neglected in previous revisions by engineering team members. It is clear that this part of the report shall be strictly confidential and for internal use only.

29. Keeping status of vendor-issued documents and issuing updated status on a biweekly basis: Normally the engineering contract for review, comments, and implementing vendor data are for a fixed duration. If a huge number of documents arrive simultaneously, the engineering team may not be able to review and comment on all of them properly. In a rush to meet deadlines some important points may be neglected. On the other hand, if vendor documents arrive very slowly and with delay, although the engineering team may have plenty of time to respond the task will remain uncompleted. This list enables the PM to expedite receiving vendor data or request added time.

30. Keeping status of expected date for vendor reply and new revision of documents and issuing expediting letters to vendor: In many cases the engineering team may not be in direct contact with vendors; besides, they may not need to expedite vendors. However, keeping track of vendor delays may help in future claims.

5.5 ENGINEERING DISCIPLINES TASKS

Members of an engineering team may be assigned as one of task force members to a project or they may stay in their own department and provide specialist services to the project team. In any case their proper functioning and interface is an essential requirement for project progress. Lead engineers are in daily contact with each other and the project team. PM or discipline head may assign certain man-hours to each lead. The man-hours have a suitable margin below the actual man-hours estimated in the contract.

In fact consultants have two types of margins. The first is on the man-hours themselves and the second is on the unit rates. Normally unit rates not only include consultant overhead (please refer to chapter “Proposal Preparation”) but also have some margin for time. Assume that for a specific task 200 MH with US$60 unit rate is assigned. Assume the engineer in charge is getting 30 US$/h and consultant overhead is estimated to be 60%. This leaves another 12 US$/h (60 – 1.6 x 30). Even using half of it provides additional 25 MH for this document with the same 30 US$/h (6 x 200/1.6/30).
This means that if there is a delay in performing this specific task, the consultant can assign extra man power as specialist study or additional part-time workforce within this limit without jeopardizing project profitability. Of course total profit is reduced.

Engineering team members have certain tasks that can be categorized as follows:

1. Preparing project documents to be issued by engineering group: In this assignment they will follow project MDR, as prepared by discipline LE and approved by PM. It is important for PM to check interface documents’ issue date with other related disciplines. For example, oily water separator PID (which is issued by process discipline) shall be at least in IFA status before oily water package MR (which is issued by mechanical discipline) is issued. EPCIC contractor may want this MR to be issued in early stages of the project as LLI. Process discipline can’t say, “I am not concerned that mechanical discipline is responsible to issue this MR very early. I have some line sizing to do and that will get me occupied. Therefore, I will issue this PID very late.” PM also can’t say, “this PID has a small weight compared to other documents and to get project progress I will instruct process discipline to concentrate on other documents.” Having internal meetings at the start of the project to finalize project MDR in a rational manner is very essential for smooth project progress. The same happens for other documents. As another example, note that electrical discipline is responsible to issue diesel generator sizing before its MR can be issued. However, diesel generator (DG) set sizing before issuing load list is impossible. To prepare load list, electrical discipline needs to get mechanical/process disciplines’ evaluation of required mechanical power of pumps and motors. In this case, ME can’t say, “I have to wait for vendor response to identify air compressor or sea water pump power.”

2. Reviewing client comments, preparing response, backup documents, confirming, rejecting, etc.: For client it is very important to get a specific response to each comment. Even if it is a trivial comment, they expect to be treated with respect. This is natural as far as certain cutting-edge investigations have not been requested. PM and LEs shall always keep in mind that they have to respond to client comments and provide necessary backup documents as far as they are within normal engineering practice. PM and LE shall carefully distinguish between normal practice and cutting-edge academic studies. In the project there
is neither time nor SOW nor budget allowance to do this type of study. Unfortunately, in this respect there are no defined boundaries.

3. It is a fact that engineering knowledge is constantly growing. Hand calculation methods are being continuously replaced with more accurate FE and CFD analysis. Newly graduated engineers tend to perform complicated time-consuming analysis methods that in many cases may negligibly add accuracy. With computer hardware nowadays analysis time may not be the governing factor. On the other hand new software generate a large volume of output, which the engineer may become lost in due to their interpretation and usage. For example, in structural analysis for each single member software can calculate exact unity check ratio under any load combination. It is neither feasible nor practical to assign a certain member size to each member to have the most efficient unity check ratio. Similar groups of members will have uniform size even though some of them may be less stressed.

4. Issuing letters, transmittals to engineering group, yards, etc.: A majority of engineering letters contain technical data. As per contract, PM shall issue letters. He will have technical background only in one discipline. Even in that discipline he is not aware of all discussions and history of certain comments. Therefore, LEs shall prepare required draft. PM may add some contractual points to it. Or after discussion with other related disciplines, he may again request from the originator LE some alterations in the letter or some additional backup documents.

5. Issuing comments to engineering group that has issued documents: As explained previously each discipline shall take IDC tasks seriously. Discipline input may be crucial to originator discipline task. In many cases IDC is not only for comment but for filling in the missing data. It was said that in a project they may decide to combine all electrical, instrument, process, and piping data for each package/pump/tank/vessel, etc. in one data sheet issued by mechanical discipline. Although piping discipline may not gain any progress for the man-hours spent on this data sheet, their input is a main portion of this document. Therefore, priority shall be given to IDC documents.

6. Reviewing yard comments and preparing responses: Client comments are mainly concerned with minimum specifications as per contract. In addition, the consultant may receive comments from fabrication yard. Yard comments may cover:
   * Fabrication methods and whether the selected details are very complicated or not
• Clashes between different parts for example piping with structure, etc.
• Undefined details in any part
• Changing specified design with existing material or more familiar methods
• Rectifying design or fabrication mistakes

7. Liaison with yards to ensure necessary documents have become available to them: This is not a contractual responsibility for the engineering team. In some projects they may not be at all connected with fabrication yard. EPCIC contractor may have its own engineering team in the head office. In that case project team may require them to perform this task.

8. Coordination with procurement to evaluate bulk material proposals: Bulk materials are those that are normally manufactured and don’t require specific engineering documentation. Structural steel including plates, rolled section and tubular, pipes, fittings, flanges, cable trays/ladders, and cables are listed in this category. In many projects, for these items only MTO is issued. MTO contains a list of required items and their standard designation. For example, stating ST355 J0 is sufficient to know material composition, yield stress, tensile strength, energy level in impact test, etc. Quantity of material will be given in the MTO. Additional contingency may be selected based on EPCIC contractor’s previous experience or recommendation. Therefore, quotation evaluation for bulk items is a fairly straightforward step. To expedite procurement, majority of EPCIC contractors may not require consultant involvement in bulk material bid evaluation. However, some small amount of help may be requested. Discipline engineers may provide assistance in this regard.

9. Reviewing vendor quotations/preparing TCs is the first step in quotation evaluation. As explained in VDC SOW, when EPCIC contractor issues sufficient number of quotations or as per project deadlines, each discipline starts preparing TC for the submitted quotations. Each stage TC shall be complete. As much as possible new clarification shall not be given unless quotation is revised from the beginning. All disciplines shall submit their queries to the discipline that is responsible for that MR. Clarification may start from general queries to ensure vendor has completely understood project SOW, specifications/requirements, and has received latest revision documents to detailed questions on functionality of the proposed equipment, material of construction, required utility, etc.
10. After receiving vendor response to the first stage TC, a second TC may be required. Related discipline engineers shall review vendor response to previous TCs and second TC is prepared by engineering group. Consultant is only concerned with technical issues. If a commercial issue is brought up by vendor, consultant only has to bring it to EPCIC contractor’s attention.

11. Issuing TCs to vendors: Final TC shall be properly signed and handed over to VDC as per project correspondence procedures. As explained before, normally the engineering team is not in direct contact with vendors. Discipline engineers hand over TCs to VDC, which in turn submits them with proper transmittals to EPCIC contractor’s procurement department.

12. Expediting vendor response to TCs is also normally out of consultant SOW. However, in some cases EPCIC contractor may ask consultant to do so. In this case the best method will be to arrange technical meetings. With new facilities telephone/video conferencing is easily possible. As per the author’s experience, even these technical meetings may not completely close the issue. Almost all vendors prefer to have sufficient time to review meeting discussions, consult their fabrication shop, and issue a commercial/technical proposal. There is no doubt that these technical meetings will reduce vendor response time considerably. It is a fact that a simple e-mail or fax issued to a vendor doesn’t show how serious the requesting body is. Therefore, they may not be so interested in responding in full detail. Each year vendors may participate in hundreds of bids. Only a portion of them are really serious and from those only from a few might a vendor succeed in getting an order. Therefore, most naturally they try to minimize their nonyielding efforts.

13. Responsible discipline for MR will receive vendor response to TC. Before instructing for distribution they have to review vendor response to TCs. In this preliminary review they will determine if requested data has been provided, and which disciplines shall receive and respond to this information. Shall VDC request for supplementary data, etc.

14. Keeping track of quotations and the response to TCs issued to the engineering group and issuing expediting letters is in VDC SOW. However, discipline engineer assigned to a specific MR shall always have a complete record of his own package status. At any time he or she shall know how many quotations have been reviewed, what are
the major/minor deviations of each quotation, which quotations are prominent, etc.

15. Reviewing vendor documents and commenting on them is the main step in vendor data review/implementation. This stage is critical in several ways. It may have cost and time impacts. This may delay manufacturing and delivery to site. Daily running cost of EPCIC contractor yard is very high. Delay in yard work schedule or rework has a considerable cost that EPCIC contractors shall try to avoid as much as possible. Therefore, consultants shall have sufficient backup documentation for each comment. This may vary from a vendor’s previous affirmative response to TC or their direct statement in the quotation or approved deviation either in TC or during KOM. For each action the consultant shall have suitable backup.

16. HOLD points in the drawings hinder yard work. Consultant shall clearly define HOLD points. More than anything else this is required to protect consultant against yard rework claims. In spite of that, consultant shall help EPCIC contractor in proceeding with work. In some cases EPCIC contractors prefer to have small reworks instead of demobilizing their workforce. In structural discipline it is possible to tack weld certain areas and proceed with the remaining work. In case future vendor data necessitates some changes, breaking tack welds is fairly easy. Consultant PM shall coordinate with discipline engineers to keep track of HOLD points. Keeping track of HOLD points and checking the possibility of removing them is to be done in conjunction with discipline engineers and PM. From one point of view, the engineering team’s responsibility is only to issue documents. Whether fabricating yard can start the job or not is the headache of EPCIC contractor PM. But this is not the whole story. It is to the EPCIC contractor’s benefit to start a mutual interaction with the consultant. This will ensure the consultant will continuously check and remove HOLD points as much as possible. In a majority of cases removing HOLD is only related to contractual liabilities. Consultants don’t want to be liable for any claims from fabrication yard rework due to implementation of new vendor data. It is to EPCIC contractors’ benefit to keep their yard progress continuous. Joint meetings can be arranged on a biweekly or monthly basis between EPCIC contractor, manufacturing yard, and consultant PMs or representatives. Such a meeting is not required in the first half of the project. Its duty will be to identify project HOLD points and the steps to
be taken to remove each one. At any time the engineering team shall know the following:

- Where are the HOLD points?
- Why are they kept HOLD?
- How, when, and by whom can they be removed?

17. It is clear that removing HOLD points is not a single-person task. Client and vendors shall participate actively in removing HOLDs. Expediting client and vendors to facilitate removing of HOLD points is another task that discipline engineers can actively participate in to help yard fabrication. This is done by clarifying what are the implications? In some cases even before receiving vendor data consultants can send existing limitations to vendors and get their confirmation. This shall be completely done via EPCIC contractor. Since vendors have to guarantee their package functioning after installation if they find anything wrong with the proposal at any stage, even if they had previously given the go-ahead signal, they will keep their right to change. In this case EPCIC contractor shall accept responsibility and doesn’t blame the consultant. Although removing HOLD points shows consultant good will to expedite project progress, it shall be very carefully controlled via EPCIC contractor’s project team. DCC team reports to PM can be helpful in expediting discipline engineers (and vendors) to facilitate removing HOLD points. Based on the previous meeting decisions/action list, consultant PM may instruct certain activities to engineering task force. This may range from repeating some analysis with certain assumptions or revisions in some documents. Interaction with vendors to provide certain documents on time and keep the issued data unchanged is EPCIC contractor’s duty. Manufacturing yard team may need to fit some sections and weld later after receiving a necessary permit signal.

5.6 GENERAL ITEMS TO BE CHECKED IN QUOTATION

Receiving a sufficient number of quotations as per contract is the first step in preparing TBE. Highly reputed/experienced vendors and newcomer vendors (which want to have a good impression on first introduction) normally prepare complete quotations. However, there are some vendors that may not send a complete quotation. They may have either had some bad previous experience with this EPCIC contractor, or think this bid is not so genuine, or simply be overloaded and don’t bother for a new project,
etc. Incomplete quotations may waste technical staff time. Normally EPCIC contractor doesn’t have either the manpower or the technical expertise to distinguish qualified quotations.

Before the actual start of TC/TBE process, a junior engineer from the consultant team may be assigned to review received quotations with a checklist. This checklist shall enable him to get a true image of quotation quality. He shall understand if the quotation is in a condition to pass TBE after rounds of technical clarification or not. If not, even before the official start of TC he shall return it to EPCIC contractor or ask for supplementary information.

A majority of, if not all, packages shall be reviewed by several disciplines. Each discipline may be interested in specific parts of the quotation. The following tries to explain what items generally shall be checked by engineers before the actual start of TC process. In addition, the interested discipline is also identified. This helps preparation of IDC transmittal. These items may be broadly categorized in contractual and technical points as follows.

Although technical clarification of a quotation is a multidisciplinary task, at this stage, only general factors that can be viewed by common sense engineering are checked. Detailed information of these items may be reviewed at vendor data stage. For quotation review, brief information or in some cases only a statement or addressing the issue may be sufficient. The responsible engineer shall decide on a case-by-case basis.

Based on the engineering contract parts of the information may be checked by EPCIC contractor or consultant. In any case, issuing a checklist to be filled in by the vendor will improve quotation quality. For small packages, requesting a large number of documents will be useless.

### 5.6.1 Contractual Points

Contractual points cover items needed by EPCIC contractor or client or help consultant in the evaluation process. Some EPCIC contractors may check their own requirements and some may assign this task to the consultant. Contractual points may range from cost-wise points to document items. In this section all nontechnical items are covered under contractual points.

1. Has vendor given the experience or reference list? This list will ensure client that vendor package is not first tested on his plant. Many clients have a requirement that accepts only well-proven designs in their platform. They are not so enthusiastic about new inventions.
2. Has vendor given the ISO or other regulating body certificates? ISO certificate is a first step assurance to client. It means proper QA and QC procedures have been established in vendor premises.

3. Majority of projects have 25—30 years of design life. Most vendors without even a track record of this long for their equipment confirm it. It shall also be kept in mind that technologies evolve very fast. Using 25-year-old technology is not recommended. Consultant shall check whether vendor has confirmed project design life or has left it unanswered. Not all packages can serve this long. However, with good maintenance and sturdy design some equipment may exceed it. The author has seen 1000 KW diesel generators that after more than 35 years’ service still could produce more than 800 KW in the worst environmental conditions. The operators credited this to sturdy design and their strict maintenance procedures set by the first area manager in that field.

4. Has vendor filled in the table of compliance? Vendor shall accept to comply with project requirements. Normally standards define the minimum requirements. In each project the client quality system or simply project interconnections may dictate specific requirements that in some aspects may exceed standard requirements. Some vendors (especially those with a production line manufacturing) may not comply completely with all project specifications. To confirm all project requirements they may need to implement some changes in their production line, which have cost and time impacts for them. They may have some deviations that shall clearly be highlighted during bid evaluation. Major deviations shall be approved by client. This table may be used by EPCIC contractor commercial team in probable future claim/counterclaim negotiations.

5. Has vendor confirmed to give documentation as per requested list? Although during bidding all documents are not required, vendor shall ensure EPCIC contractor that they will provide all documents after receiving PO. The extent of necessary documents is governed by package size, complexity, function, etc. It is quite clear no vendor will provide the same number of documents for US$10,000 and US$10,000,000 packages. Requested documents may serve different purposes. As described in Section 5.4.1, vendor documents may be divided in several groups like contractual, engineering, manufacturing procedures, QC/QA, and operation/maintenance groups.
6. Has vendor accepted the priority of documents in case of conflict? This may seem a trivial point but it is not. Many projects have their own specific requirements, which may be higher than minimum standard requirements. If document priority shows general standards to be higher than project specification, then defining more strict requirements in project specification becomes useless.

7. For some packages client may request special certificates. These may vary from design verification certificate (DVC) for engineering activities or certifying authority (CA) for applicable procedures or TPA approval for manufacturing. Consultant shall check which one of these has been requested in contract and implemented in the MR. Some vendors may accept TPA or CA but for DVC request additional cost as option. Consultant shall ensure which parts have been confirmed by vendor and highlight the remaining. In some cases maybe type-approved certificates can be replaced with some requirements.

8. Most vendors have their own numbering system. This covers both equipment part list numbers and document numbering. Changing it and adapting to project numbering system is time-consuming and they dislike it. Changing part list numbers is impossible because later they can’t find that part if a new order is placed. Normally after a package is sold for a few years the vendor has to supply spare parts. In almost all projects clients give an additional order for spare parts recommended by the vendor for two years’ duration. In addition, vendors have to guarantee several more years (at least 10 yr) to provide package services. Normally vendors have no objection to put project tag numbers on equipment nameplates. In documents usually they put both numbers. Consultant has to check if vendor is using his own tag number or is following project tag numbers. This will facilitate future document tracing or spare part ordering.

9. Some vendors may have specially developed in-house software for their technical calculations. This is okay. However, there is general purpose software for writing reports, preparing sketches and drawings, etc. Vendor documents shall follow project requirements on the type and version number of this software. Consultant has to check whether vendor has confirmed to issue documents in the requested software’s format or not.

10. In many packages using a typical design will considerably reduce package cost and manufacturing duration. Consultant shall check whether
vendor has provided any typicality or not. If yes, then each typical item specification shall be checked with project requirements to ensure they fulfill project minimum requirements. In a majority of cases there will be some deviations. Consultant shall identify major and minor deviations and if necessary ask vendor to provide backup documents for relaxations.

11. Has vendor accepted the guarantee period for his package? If not specifically mentioned in the quotation, then vendors’ normal terms and conditions are applicable. This is not a technical issue but is an important contractual item. After dispatching the package and before its actual installation and commissioning on the platform there is always a time lag. Normally vendors can accept a period of 18 months after dispatch from their yard to 12 months after installation on the platform (anyone that occurs first). Some clients may request longer duration. Vendors may accept it, especially if they want to promote their production.

12. Some vendors may develop special welding procedures for some materials. Based on material type, hardness, thickness, and grade they may mobilize certain equipment. It is very unlikely that only for one project a vendor mobilizes new equipment. Consultant shall check whether vendor has confirmed material of construction according to project requirements. The following items shall be checked: skid, vessels, piping, instrumentation, cables, trays, electromotor, mechanical equipment, etc. For example, a rolling machine suitable for a diameter up to 800 mm can’t be used for vessels with a diameter of 2300 mm. In that case the vendor has to nominate subvendors eligible for the required tasks. Normally in the quotation subvendors will not be listed. However, during quotation review stage EPCIC contractor or consultant shall check whether subvendors are needed, and during vendor data (if PO is placed in favor of this vendor) shall ask for subvendor list and their capability definition. In some projects or for certain unimportant equipment client may relieve itself from subvendor checking. In this case since the vendor has full responsibility for the whole package the client may accept vendor confirmation of subvendor capabilities. For important packages availability of necessary machinery can be verified at KOM during vendor fabrication shop visit before the start of any activity.

13. Attending factory acceptance tests (FAT) is very helpful to ensure package will function properly during commissioning and later in
platform operation. In third world countries bureaucratic routines to get visas and arrange for tickets, hotels, etc. need some time. In some cases higher management permission for each trip shall be obtained. Even with a competent project team the coordination takes considerable time. In the majority of projects an inspection test plan (ITP) requires that client representatives at least take part during FAT. Few clients may grant vendors the permission to proceed with TPA in client absence. Some may HOLD test, which leads to delay in package delivery. To avoid this problem consultant has to check whether vendor has confirmed to give sufficient advance notice for attending the FAT.

14. Before installing the package in its final location, it has to be lifted and transported from vendor workshop to transit truck, from truck to shipping vessel, then to customs area, from there to the next transit truck, from truck to storage area, and finally to final location on the platform. In all these movements package has to be lifted and transported in a safe and proper manner. Some packages may need special lifting tools. Others may use normal items like nylon straps to avoid damage to paint, spreader bars to transfer sling lateral force to vertical load, etc. It may require securing specific lashes or removing them at later stages. Vendor has to specify any special lifting device, procedure and undertake its cost/responsibility from its own manufacturing yard to shipping vessel. Consultant has to check whether vendor has provided for temporary lifting, transportation, etc. in its quotation.

15. Has vendor confirmed to supply the special tools, insurance, and capital spares? Inside some packages there are some remote points to which access is impossible unless special tools are used. They may also be used for lifting and handling purposes. In addition some major items like valve seats may need replacement after several years’ usage. These are capital spares. EPCIC contractor has to ensure that vendor has included these items in their proposal and as part of their SOW.

16. Has vendor given the list of commissioning and start-up spare parts and confirmed to supply them? This is again not a consultant headache. However, they are very important during package commissioning. Without them considerable delay and cost impact may be anticipated. Similar to 2-year spare parts, vendor is the best authority to determine it. Commissioning team of EPCIC contractor may have some minimum requirements but normally will not relieve vendor responsibility.
17. Has vendor given the list of 2-year spare parts? This is not a technical issue to be a consultant problem. However, the client always wants it. Operation and logistics engineers may comment on this document. Before their comment the related document shall be presented. Normally the vendor is the right one to propose the 2-year spare part list for their package. Client may add a few items or increase some of the requested numbers to be on the safe side during operation.

5.6.2 Technical Points

Technical points are those affecting consultant evaluation of vendor quotation. They may cover a variety of items that can be easily checked and have important impact on design.

18. Does proposed package fit to the area allocated by the design team? Package GA and footprint dimensions are very important in technical evaluation. In some cases it may affect structural design considerably. Normally packages are not rejected due to structural problems. As much as possible structure is adapted to accommodate them. In onshore plants there may be plenty of space to relocate large equipment. Normally a wide area is used for access and transportation. A small part of it will solve increases in package dimensions. In offshore platforms space has always been a main concern and is a precious commodity. Economical adequate space for accommodating all packages, providing sufficient access, maintenance area, and escape route are important design criteria. For all packages a tentative GA dimension is necessary. In each quotation consultant shall check if vendor has provided the preliminary GA or not. Later in the vendor data review stage layout team (PI) and support design team (ST) shall carefully review this information.

19. Has vendor confirmed receiving latest revision of documents? Sometimes to expedite project progress EPCIC contractor may receive quotations with IFA revisions. They may undergo some changes after upgrading to AFC. Consultant shall always ensure that vendor has received the latest project documents. This may impact material of construction, scope of supply, package input and output interfaces, etc.

20. Has vendor provided any data about center of gravity (COG)? Support skid info and COG location affect load distribution. For small packages it may affect local design and for large packages it may impact both local and global design (ST).
21. Has vendor filled in project data sheets? Project data sheets provide complete information for the package. If vendor fills them in, it means they are accepting responsibility for the given data. It will reduce considerable work later for consultant and will enable early approval of vendor documents. This will expedite production and finally reduce delivery time. Several disciplines like mechanical, process, electrical, etc. may review parts of data sheet info.

22. Has vendor provided mechanical or process guarantee? Some packages (especially process equipment) require process guarantee. At least on paper if a vessel designed to remove a certain percentage of water from crude doesn’t perform this function, the vendor has to adopt certain corrective measures. If vendor design team or design subcontractor doesn’t possess required qualifications then reviewing their proposal will be useless (PR, ME).

23. Has vendor provided PIDs for his package? For some single-item packages like vessels PID is not required. For others even a preliminary PID accompanying quotation will provide lot of information about package operation, isolation, and controlling. Most vendors are reluctant to do this and try to postpone it after firm PO. This may be for several reasons like not showing their proprietary design to competitors, not accepting liabilities on the design. The main reason they officially state is that they have not designed the package yet and therefore data may be misleading. This is not a good excuse and simply tagging “For Information Only” in the title block or in the background of the document will solve it. Reviewing PID is a multidisciplinary request and task.

24. Environmental conditions play a major role in each package operation. Consultant shall check whether vendor has confirmed environmental conditions like temperature/humidity, seismic levels, etc. as specified in MR. Equipment designed for arctic conditions may not perform well in tropical area. As an example, diesel engines have a high cooling demand. One common solution is to circulate cooling water, which absorbs heat from combustion cylinders and exchanges it with another absorbing media. One of the most common heat exchanger media is air. The heat dissipation is done in air-cooled radiators. Heat dissipation rate depends on change in air temperature. If outside air is warm (say 40°C) a large volume circulation is needed. Because at maximum its temperature may be raised to 50°C, this means larger fan diameter and rotation speed, which in turn requires
more power. The same generator with cooling air temperature of 20°C requires much less cooling air circulation (multidisciplinary request and task).

25. Most vendors have few painting specifications which have been suited to their paint shop. Project paint specifications may be different. Consultant shall check whether vendor has accepted project specifications or is providing his own surface preparation and painting. It shall either be according to project specifications or vendor shall confirm suitability of his own proposal for project environmental conditions. Some vendors may highlight their routine painting specifications in the main cost and request for optional additional payment to follow project instructions. Many vendors have special topcoats for their brand like yellow for Caterpillar and Liebherr. Code regulations specify red for safety equipment like deluge valves, or orange for life boats. These requirements can’t be changed. It is to be noted that topcoat color is not the main concern for packages and consultant shall concentrate on thickness and material of primer and main coats (PI).

26. Each package has interface with others. They will use utilities provided by platform equipment like electric power, compressed air, etc. In calculating these utility demands and preparing their data sheets the related discipline depends on the data provided by other disciplines. If there is a gross mistake in calculating utility capacity the possibility of shutdown during platform operation will increase. Many packages (like high discharge or high head pumps) have high current demand during start-up. This may lead to generator shutdown due to high demand, which in turn may lead to platform shutdown. The same may happen to others. Generators have high cooling demand. If radiator is air cooled and located in a tropical area in hot conditions it may require a large air flow. Air fan increased dimensions not only may impact power demand but also have structural and architectural impacts. The same may happen to fuel demand. If a generator is consuming a large volume of diesel oil, proper storage and pumping capacity has to be foreseen. This is valid for all packages that require a utility line to be supplied from the platform. Consultant shall check whether vendor has stated the utility consumption including compressed air, electricity, fresh water, sea water, etc. Checking, providing, and design of necessary tie-in for interface items is also a multidisciplinary requirement and task.
27. Other than QA requirements all projects have their QC requirements. Standards define a minimum level of QC tests. Some projects may require more tests. In addition to that, if a vendor is on the client approved vendor list, minimum nondestructive testing (NDT) levels may be okay, but for vendors not on it additional tests may be specified. This may range from increasing NDT percentage (especially radiographic tests (RTs)) or even requesting destructive tests. Performing these tests increases manufacturing time and associated costs considerably. To keep their quotation costs at a reasonable and competitive level some vendors may just mention QC tests as per code or even refer to their own in-house procedures. To ensure project quality level has been maintained, consultant shall check whether vendor has confirmed compliance with NDT requirements, eg, postweld heat treatment, RT levels, etc.

28. Some platforms may be manned. Recent design trend is toward remote control systems. Recent technological achievements have provided a very good chance for this issue. At the same time suitable measures shall be considered to prevent unwanted problems, which may lead to cascading events leading to disasters. This may be achieved by proper logic system and dual control unit hardware. Remote control unit may be located in central control room or be implemented in the control software. Consultant has to check whether vendor has confirmed local and remote control philosophy including required hardware and software.

5.7 PLANNING AND PROJECT CONTROL DEPARTMENT

Planning department is a powerful help for PM to measure progress, identify delays/areas of concern/select mitigating measures, provide backup documents for claims and counter claims and revise plan. Their tasks can be divided into two broad groups, the first being project financial issues and the second project control issues. In a sense these are not separated from each other because project progress is controlled to ensure contractual obligations are followed. Contractual obligations are followed to ensure client payments are on time and future projects may be secured. The distribution given below is not unique. As explained before (based on project scale) planning personnel can be stationed in DCC or in planning department. Their duties can also be distributed in part to DCC personnel.
5.7.1 Financial Issues

As stated already these two sections are not isolated items that don’t have any impact on each other. The ultimate goal of financial check is to ensure a project is profitable. In addition to that, project cash flow shall also be positive. Some of the checkpoints include:

1. Defining physical and invoicing progress measurement procedure and agreement with client on documents’ weight factors is the first and main task of planning department. In many projects invoicing progress is only defined as per specific milestones. Before receiving a document in a certain stage, client will not accept to pay for the work in its production stage. The most customary milestones are IFC, IFA, and AFC. Normally 60%, 80%, and 100% invoicing progress is calculated for them. In few projects and in order to help consultant cash flow status, client may accept to pay for intermediate steps like at the start of a document or its issuance for IDC. Whether a certain document like weekly assignment or IDC transmittal shall be presented for client approval of the related cost or not remains for mutual agreement. In some projects client may require a work progress appraisal report (WPA) before issuing any invoice. This WPA has to be reviewed, commented on, and approved by client planning team before issuing the related invoice.

2. All contracts require progress monitoring. It may be on a weekly/biweekly or monthly basis. In certain projects based on project status different reporting duration may be selected. For example, at the end stages when all design documents have been issued and only a few documents remain to be revised (due to vendor data implementation) longer reporting duration may be selected, while in the mid-stages weekly reports are needed.

3. PM may need to compare the engineering team outcome with the acceptable invoices from client. This may be understood as a managerial tool to predict project loss or profit beforehand. To do this, the planning department compares the consumed man-hours with the performed jobs in each week. Since all documents undertaken by disciplines in a week may have not reached invoicing stages, physical progress rates shall be used. Of course it is understood that physical progress will equal invoicing progress at the predefined stages. For example, if IFC invoicing is selected to be 60%, its physical progress after issuing the related document at this predefined stage can’t be less or more than invoicing progress.
4. Although MDR determines documents to be worked upon at each week, PM has some freedom in defining weekly assignments. Each week the planning department reviews assigned jobs in disciplines and calculates physical/invoicing progress of each. Based on that, PM may reschedule MDR to replace new documents with higher weight with low invoicing-value documents. This is not a routine job. However, it allows some freedom to PM to control cash flow. In some extreme cases (mostly in IFC stage), PM may instruct discipline engineers to officially issue a document even before completing all design review stages.

5. Although latest status of issuing design documents may be continuously updated by DCC staff after issuing the related transmittals, the planning group also needs it for both project control and invoicing purposes. Therefore, in some projects maybe DCC SOW is limited to preparing transmittals. They will submit a copy of the issued transmittal to the planning department and updating MDR is assigned to planning.

6. Progress/invoice approval in client team may be done by two different teams or personnel. Progress is checked in WPA by project control team and invoice is checked based on approved WPA in financial department. For several reasons such as lack of project budget, contractual accepted time lag between progress approval and actual payment, client PM's intention to apply financial pressure on consultant or encourage its team, etc., actual payment may be different from approved progress. Planning department shall prepare payment status report to enable PM to highlight it in weekly or monthly reports for necessary client action.

7. Normally, consultant may not have subcontractors, but for special studies and activities like HAZID, HAZOP, etc. they may employ third-party services. Clarifying subcontractors’ payment status is an important task that helps PM in project cash flow measurement.

8. Very few (if any) contracts may finish based on original instructions. In the majority, client will instruct changes orders (CO). Although it is preferable not to perform any CO without prior agreement on its time/cost impact, in majority of cases consultant has to proceed with CO before client approval. Planning shall keep a clear record of CO status including the claimed value, consumed man-hours and cost, percentage of performed job on each CO, their invoicing, and client payment status. If the gap between payment and performed job
increases tolerable values, PM shall be informed to take proper action. It may vary from a simple letter expediting payment to stopping work on some items.

5.7.2 Project Control

Project control intention is to give the real status of the project to PM. He or she shall understand, what are the shortcomings? Which items need further strengthening? What mitigation measures shall be applied? What catch-up plan shall be prepared? Some of the required information includes:

9. All weekly or monthly reports require next week or month look-ahead plan. This may include a brief explanation of general tasks to be undertaken by engineering group or a detailed list showing document number/tasks description to be assigned to each discipline for the coming period. To prepare it, the planning team uses MDR-planned column. However, they have to carefully examine the status of each document to check three issues:
   - Some documents may have been prepared ahead of schedule.
   - Some documents may lag behind schedule or be part of catch-up plan.
   - PM may wish to exclude some documents from next-period tasks and include some others. This may be due to EPCIC project requirement, yard request, procurement status, its higher weight to compensate for cash flow, etc.

10. Procuring long-lead items is an important factor for EPCIC contractors. Their procurement team requires some time for obtaining quotations. In addition, the engineering team itself requires some time for technical evaluation of quotations. Planning department shall continuously monitor MR issue status (with emphasis on long-lead items). This will enable PM to reschedule their plan or devote extra man power or resources to bring them in line with project requirements.

11. In some contracts client may not accept upgrading a document to next step before receiving/responding to client comments. At least this may be valid for documents in approval category. On the other hand, consultant can’t wait endlessly for client comments. Planning group shall prepare the latest status of client comments on design documents and delays. If contractual terms allow it, after a certain period with no response from client the related documents may be deemed approved and consultant can proceed with next stage. If not, PM shall highlight delays impacting project progress and request for their immediate
response. This list may be the major source of backup document used for claims and counterclaims.

12. If engineering contract requires CA approval, planning department shall prepare and update status of issued documents for endorsement and CA response. It will serve two purposes. The first is to help in upgrading to AFC stage and the second is in delay calculations.

13. Almost all contracts have a limit on number of received/evaluated quotations. It is always more efficient to start technical evaluation of all quotations for a certain package simultaneously. Although in some contracts EPCIC contractor may be required to issue official bid evaluation letter, mostly they fail to do so. Therefore, planning shall prepare quotation status. This will enable PM to decide starting TC preparation for a certain package.

14. Issuing TBE by consultant is the first step to allow EPCIC contractor issue PO. Only after this can the consultant expect to receive vendor data, which is the start of the project end. Project control team shall continuously monitor TBE status. This allows PM to check with responsible disciplines to find delay reasons for TBE in each package and probably find a solution. Remedial action may range from technical meetings with vendors instead of issuing another TC round or technical meetings with client to close minor deviations, etc.

15. Although VDC team fills in the data base for vendor data status, it is project control responsibility to process it. Brief reports showing percentage of data received from each package in different disciplines help PM to understand how much of vendor data is covered. In spite of engineering documents, it is difficult to assign weight factors to vendor data. Weight factors enable accurate progress calculation. For the engineering team only those data that may affect platform design are important. In addition, there are numerous data about scheduling, organization, QC reports, etc. that are not reviewed. It is important to note that QC documents shall be carefully reviewed by EPCIC contractor team to ensure compliance with project minimum requirements. A simple approach may be to give zero weight to documents not having impact on engineering design. In this approach, to approve vendor data completeness first all documents should have been issued and, second, main documents shall receive approval.

16. It is a fact that no delay has a single cause. Each party may be responsible for a portion of the delay. At the same time that project control people are monitoring client delays to be ready for future
claims/counter claims, they have to monitor the engineering team’s internal actions to be able to prepare catch-up plans and take remedial actions. In some cases PM may decide to have a stricter internal plan. As explained, PM may select to remove the contingency part of man-hours and assign actual calculated ones to each discipline. This may act as an internal plan. Progress and delay may be calculated on this basis. Project control department may use this plan to calculate discipline delays and prepare internal catch-up plan. If this approach is used, they must be very careful not to mix the two plans.

17. As explained for internal plans, external plan is according to consultant contractual obligations to client. PM will try to extend activities as much as possible. This will allow him to uniformly distribute man power. Catch-up plans formally issued to client are normally less strict than internal plans.

18. Calculating delays and preparing catch-up plan are similar to QC activities. They measure the performed action and recommend remedial action if needed. In addition to it, similar to QA activity, project control team shall expedite discipline engineers and keep track of promised issue dates of documents as per document register before their deadline arrives. This activity may help each discipline’s lead engineer to reschedule tasks or put additional man power on a certain task that is delayed behind schedule, or accept overtime work on a certain activity, or even outsource it. Each LE has partial or full freedom in OT assignment, but prior to outsourcing shall get PM approval.

19. Updating discipline document register in cooperation with discipline lead engineers is mainly done to enable them to monitor their own activities.

20. At each stage, the project shall have a final list of latest-issued documents. This may be a separate list or may use MDR. Project control shall keep the final list and revised number of issued documents on a weekly basis.

21. Both for managerial information and to complete weekly/monthly reports the project control team shall prepare a report on document issue status, delays, expectations, etc. This may be in two levels. The first is for higher management information and is brief. It only shows a general list showing number of documents per discipline divided in each stage with their status. The second is more detailed. It separates different classes of documents per discipline and per document category. From this list the PM will understand how many data sheets,
specifications, MRs, etc. per each discipline have been issued and had to be issued. This shows number of delayed documents. It is possible that some documents intended to be issued are delayed but others are given priority. Based on discussion with PM, discipline LE may decide to reschedule some documents’ order. Although PM may have some reasons other than progress in this decision, it is project control’s duty to inform him of the net outcome of this decision.

22. Issuing some documents is related to client responses. Consultant may issue several queries to understand preferred course of action. It is recommended to set a deadline for response and inform the action that the consultant will continue if query remains unanswered until that time. Keeping a list of engineering queries and client expected response dates, their closing dates, results, etc. enables PM to decide with LEs.

23. Change orders may constitute a considerable portion. In a majority of contracts the client is allowed to add or deduct 25% of the original contract value without needing to make a new bid. Project control team shall update related change order list and prepare a summary report to enable PM to understand where the project stands. It may be that change orders detract project from its actual path.