



Engineering and technical support of construction (revamp) of industrial facilities LIST OF ACTIVITIES

1 Analysis of design and technical documentation

1.1 Review and analysis of project design packages:

- § check of completeness and interconnection of separate design sections;
- § evaluation of design solutions for compliance with requirements of codes and rules;
- § analysis of design packages for completeness of information concerning pre-commissioning of the production facility, safety bringing of the facility on to a stable operating mode, development of operations and start-up documentation;
- § development of recommendations for corrections of separate design solutions; approval by the Customer and design company;
- § selection of optimal ways of pre-commissioning, start-up and commissioning;
- § development of design solutions for start-up and commissioning (if required).

1.2 Analysis of construction management projects, work production plans (including welding procedures and used materials), corrections and issue of recommendations (if required).

1.3 Review and analysis of technical packages of equipment, devices and apparatuses manufacturers:

- § study and analysis of equipment manufacturers' technical packages (certificates, drawings, manuals, calculations);
- § analysis of compliance of equipment operational parameters stated by manufacturers' documentation with the design operating conditions of the facility.

1.4 Review and analysis of operations documentation developed by the design company and the Customer for compliance with requirements of technical norms and standards. Issue of offers for correction of operations documentation using previous experience of operations documentation development for similar production facilities.

2 Development of documentation

2.1 Development of organizational and technical documentation:

- § work plans;
- § schedules and procedures of pre-commissioning, start-up and commissioning;
- § package-wise, stage-wise and equipment-wise local schedules and procedures of pre-commissioning, start-up and commissioning;
- § complex programs of stage-wise putting of facilities into operation including technological sequence;
- § network schedules, and programs synchronizing completion of construction-erection works and pre-commissioning, start-up and commissioning activities.

2.2 Certification of equipment and pipelines:

- § development of certificates for the equipment subject to registration by state supervision authorities;
- § development of certificates for the equipment subject to registration by the technical supervision department of the Customer;
- § development of process pipelines certificates;
- § development of steam and hot water pipelines certificates;
- § development of certificates of fuel gas pipelines within Battery Limit.

2.3 Development of operations documentation:

- § process procedures;
- § emergency response plans;
- § operating instructions for units, plants and other process facilities;
- § work stations operating instructions;

- § operating instructions for separate kinds of equipment;
- § forms of operating practices specifications and reports of operating parameters control;
- § schedules of analytic control;
- § operating instructions of auxiliary facilities (firefighting, ventilation, sewage disposal, heat and water supply, power supply, communication, video monitoring, etc.).

2.4 Development of start-up documentation:

- § equipment and pipelines purging diagrams and programs;
- § equipment and pipelines blow-down diagrams and programs;
- § diagrams and programs of equipment and pipelines separate tests and unit-wise trial runs;
- § programs of furnaces and fire-heaters refractory dry-out;
- § programs of catalysts, adsorbents, packages charge-discharge;
- § processing units start-up instructions;
- § diagrams and programs of pre-commissioning of compressor plants and pumping units oil systems;
- § instructions for special kinds of works, specified by design and procedure;
- § additional leak tests programs;
- § programs and diagrams of systems inertization prior to start-up;
- § diagrams of blinding (shutdown diagrams) during stage-wise start-up and start-up in the course of expansion of production;
- § lists of extra equipment and materials, hookups and auxiliaries required for start-up and commissioning;
- § programs of operating media and utilities charge;
- § schedules of analytic control during start-up period.

3 Procurement

3.1 Management of incoming inspection of equipment and materials including:

- § inspection of equipment and materials after transportation;
- § control of accompanying documents (certificates, specifications, reports of equipment usability, etc.) that prove the quality of equipment and materials;
- § check of completeness, grade and quality of equipment and pipelines; external and internal inspection of equipment and pipelines; revision of tag numbers and trademarks for compliance with accompanying documentation.

3.2 Organization of equipment and piping storage in easy-to-issue order.

3.3 Making up the sets of equipment, materials and pipelines prior to issue for erection.

3.4 Execution of required documentation for receipt and issue of equipment and materials.

3.5 Control of equipment supply schedules, generation of reports, recommendations.

4 Supervision of equipment and pipelines construction and erection

4.1 Approval process of the matters associated with installation, testing and registration of process equipment, hoisting devices, gas pipelines, steam and hot water pipelines in inspecting authorities.

4.2 Control of documentation that proves the quality of structures, equipment and materials used at the construction site (manufacturer's certificates, certificates, laboratory tests results, etc.).



Engineering and technical support of construction (revamp) of industrial facilities LIST OF ACTIVITIES

4.3 Engineering supervision of Instrumentation and Automatic Control Systems (ACS) erection:

- § determination of readiness of structural part and process equipment for Instrumentation and ACS erection;
- § check of detail documentation for compliance with regulatory documents;
- § participation in status check-up of Instrumentation and ACS prior to erection;
- § supervision of Instrumentation and ACS erection, tubes installation and cable lying;
- § supervision of Instrumentation and ACS tubes strength and leak tests;
- § participation in separate operation tests of automation systems.

4.4 Engineering supervision of construction-erection works:

- § inspection and acceptance of foundations and support structures prior to equipment and pipelines erection;
- § supervision of pre-installation inspection of pump and compressor equipment and pipelines valves;
- § check of level and leveling of equipment on the foundations;
- § control of process equipment and utility systems erection including quality control of works and conformity of works to the design;
- § supervision of equipment inner parts installation, refractory lining installation, anticorrosion protection of equipment;
- § supervision of installation of electrical equipment, cables lying, installation of ventilation and conditioning systems;
- § supervision of installation of equipment and pipelines heat insulation, protective earth and static discharge protection;
- § engineering supervision of hydraulic and pneumatic tests;
- § control of observance by Contractors of the Author Supervision, State Construction Inspection Authorities instructions and orders, and the Customer's engineering supervision requirements concerning the quality matters of construction-erection works and used structures, products, materials and equipment;
- § determination of scope of as-built documentation required for commissioning acceptance of facilities in accordance with the active codes and rules;
- § check of as-built and commissioning documentation of installation companies for completeness, quality and compliance with regulatory documents;
- § participation in acceptance committees for quality control of executed construction-erection works.

5 Pre-commissioning, start-up and commissioning

5.1 Pre-commissioning

- § development and approval process of start-up and commissioning schedules (including plants, divisions and units breakdown);
- § division of the facility into separate systems (circuits) with common parameters (media, pressure, etc.) for separate tests and leak tests;
- § development and approval of circuit diagrams;
- § development and approval of equipment blow-down and separate tests programs and diagrams;
- § development and approval of design assignment for temporary pipelines and devices for start-up and commissioning;
- § development of specifications of temporary pipelines and elements of blow-down, purging, separate tests diagrams;

- § listing and quantity calculation of reagents, material and energy resources required for start-up and commissioning works and complex testing of facilities;
- § development of special Labor protection and Safety activities during start-up and commissioning at facilities under construction and in work mix conditions;
- § quality control of Instrumentation and ACS adjustment/calibration.

5.2 Commissioning activities prior to separate tests:

- § check of executed erection works for compliance with the design, codes and rules of the Customer's country and manufacturers' of equipment; generation of defects reports;
- § supervision of temporary pipelines and devices installation providing blow-down, purging and separate tests of equipment and systems in required mode;
- § operational tests of air and water supply process units for execution of blow-down, purging and separate tests;
- § check of completeness of sets and serviceability of control and shut-off valves used during separate tests;
- § commissioning of off-plot facilities, auxiliary systems, equipment, ACS providing separate tests;
- § instructing of installation organizations' personnel on the procedures of blow-down, purging and separate tests in the work mix conditions.

5.3 Commissioning works during separate tests

- § technical management of equipment and pipeline systems blow-down and purging;
- § technical management of equipment and pipeline systems separate tests;
- § technical control of restoration of designed process flow diagrams after blow-down, purging and separate tests;
- § technical management of catalysts and packages charge;
- § technical management of equipment and pipelines pressure tests after designed process flow diagrams are restored;
- § technical management of equipment trial start-ups and trial runs; off-load and on-load functional test of equipment;
- § tests and acceptance of DCS and ESD alarms and interlocks; start-up of control system.
- § off-line commissioning of automation systems:
 - check of instrumentation and automation equipment installation for compliance with manufacturers' certificates and design; replacement of defective parts;
 - check of marking and phasing, check of actuators specifications;
 - setting of logical and time interrelations of the alarm, protection, interlocking and control systems, verification of signal passage;
 - preliminary identification of the facility characteristics, calculation and setting of the system hardware parameters;
 - preparations and start up of the automation systems to provide process equipment separate test and setting of the hardware parameters in the course of operation;
 - execution of production documentation (acts, test reports, etc.).
- § execution of sheets of defects uncovered during separate tests; working-out and execution of measures for defects elimination.



Engineering and technical support of construction (revamp) of industrial facilities LIST OF ACTIVITIES

5.4 Commissioning during complex testing; putting into operation

- § development of the plant start-up/shut-down procedure;
- § development of the plant (unit) complex testing program with the use of inert and operating media;
- § instructing of the operating personnel at the working stations and introduction of the stage-wise program of complex testing;
- § complex testing of the plant with the use of inert media (air, nitrogen, water) including:
 - adjustment and control of utilities and inert media supply to separate units and adjustment of circulation;
- § functional check of principal and auxiliary equipment, shut-off and control valves and actuators in the manual mode;
- § pressurization up to operating pressure value and verification of reliability of maintaining operational parameters;
 - adjustment and control of the process flows, functional check of equipment, control and value limit alarm systems. Verification of process parameters limiting values and adjustment of parameters throughout all vessels and pipelines;
 - reading integrity check of different level instruments (equipment - local panel – control room).
- § complex setting of automation systems:
 - check of accordance of alarm, protection and control system devices and components actuation sequence with the set algorithms. Identification and elimination of failures and false actuation, setting the proper parameters for the coordinate control actuation;
 - check of valves capacity and check of conformity of actuation sequence of the switches with the process requirements;
 - check of flow parameters of control devices and setting to the proper values;
 - preparation and start up of automation systems for the complex process equipment test run;
 - precise determination and correction of static and dynamic parameters of the facility, correction of the system settings taking into account their interaction in the course of operation;
 - testing and identification of the automation system capability to ensure equipment operation with the design capacity;
 - analysis of the automation system functioning during operation;
 - execution of the production documentation.
- § technical management of operating media charge to the unit; execution of required permissions, approval, orders, etc.;
- § complex test of equipment with the use of operating media including
 - adjustment, control and setting of separate stages of the process in line with control systems, adjacent stages, synchronization of equipment operation and automation systems;
 - identification of defects and failures. Supervision of defects elimination;
 - validation through elaboration of technology; achievement of the designed (optimal) parameters;
 - production of the pilot batches and bringing the process on to the stable operation mode.

- § analysis of the unit operation during complex test run and commissioning; identification of defects, generation of the defect report and technical recommendations aimed to elimination of defects;
- § startup of the unit and 72 hours operation control of production process during the production test at continuous stable mode of operation; generation of report on completion of the complex test run;
- § generation, approval process of technical reports on the completed work. Submission of the report to the Customer;
- § acceptance into operation of completely constructed facilities; execution of all required technical documentation; participation in the facility review committee;
- § organization and implementation of guarantee tests.

6 Training of operating personnel:

- 6.1 Development of training programs in accordance with technologies used at the facilities under construction.
- 6.2 Technical assistance during agreement of training programs.
- 6.3 Theoretical courses for personnel in accordance with Labor protection and Industrial safety requirements.
- 6.4 On-the-job Safety practices training of operating personnel in the course of equipment testing and start-up and commissioning activities.
- 6.5 Training of operating personnel's actions in contingency and emergency situations.
- 6.6 Organization and execution of competence assessment for unrestricted work permit previously to start-up.
- 6.7 Participation in a personnel review board.
- 6.8 Organization of the Customer's personnel probation at the similar operating facilities.

7 Support of the facility operation

- 7.1 Consulting services for operating personnel during period of pilot production (2-3 months).
- 7.2 Periodic functional check of equipment and process flow for conformity with design parameters during guarantee term.