

MODULAR SKID MOUNTED PRODUCED WATER TREATMENT & RE-INJECTION SYSTEM

Modular Skid Mounted water treatment and reinjection systems are proving to be a beneficial alternative to conventional plants for water treatment in Oil & Gas upstream processes

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Modular Skid Mounted Systems are emerging as a viable and beneficial alternative to conventional plants constructed at site on EPC basis by Oil & Gas industries. Modular equipment offers several benefits including flexibility in plant erection through plug & play mode, fewer safety concerns during construction, ease of equipment modification and shifting of the plant from one asset to another.

In a modular skid-mounted plant, the process equipment, instrumentation, valves, piping components, and electrical wiring are mounted within a structural steel framework (i.e. skid or module). Each skid is a self-contained process unit that is typically assembled in the supplier's plant. A modular plant can be comprised of many unit operations contained on a single skid or on multiple skids that are connected at the production site to form a large process system.

The modules are shipped to the manufacturing site, where they are erected and integrated into the final orientation. Once at the end user's facility, the units can be connected to the site utilities and tested in place for startup and commissioning.

Modular skid-mounted construction offers many benefits as under:

- ▶▶ Safety at Site/ Asset: Modular skid mounted plant being dispatched after being fabricated and assembled on the skid is not exposed to safety risks in site construction and hazards associated with working at heights, the use of heavy machinery, electrical work, and so on.
- ▶▶ Quality: Modular equipment is often designed and built at one location in the factory, which enables better communication between the design and build teams. The quality of fabrication, assembly and testing at the factory is also superior to on-site same activities.
- ▶▶ Lower Delivery/ work completion time: The turnaround period from design and engineering to dispatch after manufacturing, assembly and testing are much shorter. The installation time on the foundation is very small.
- ▶▶ Flexibility: A modular plant consisting of several skid units offers flexibility in several ways. Small, skid-mounted production units can be operated at one centralized location or at several geographically dispersed locations. Further, the output can be easily scaled up to meet changing demand by additional skids in parallel. Modular plants also can be shifted from one asset to another.

While modular plants offer many benefits, those must be weighed against the drawbacks of modular construction like transportation costs considering very high quality of packing of the integrated system and transporting the large system to site; higher cost of metallic equipment and their fabrication compared to the structures in concrete and finally, limitation in size of plant



which plays major role in deciding to go for modular skid-mounted designs.

Modular skid mounted plants have gained prominence for various on-shore and off-shore Produce Water packages for Oil Collecting Stations (OCS) and Group Gathering Stations (GGS).

Produce water is a term for reservoir water that is produced along with oil and gas phase. Oil and gas reservoirs normally contain an amount of water, oil, solids, condensates & gas. When oil & gas are processed, process water is separated and pumped back into the reservoir in order to maintain the right pressure in well.

When the oil & gas reservoirs become older and depleted, the water content increases as much as 98% in the total fluid being produced and oil quantity reduces.

As a result, the treatment of produced water to required quality levels and re-injecting the same in the reservoir contributes significantly in saving total Life Cycle Cost of an operating asset.

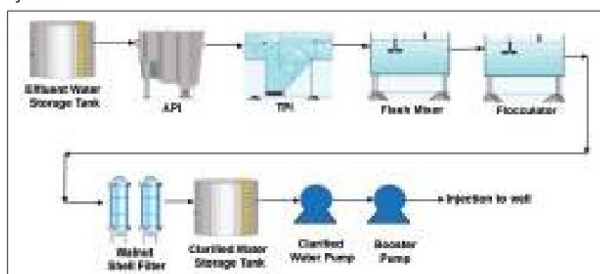
OIL INDIA LIMITED, for the first time in Oil & Gas industry, decided to go for Modular skid mounted Produce Water package & ordered on Paramount Limited such packages for their Oil Collecting Station (OCS) at Nadua and their Group Gathering Station (GGS) at East Khagorijan in upper Assam.

INLET AND OUTLET CHARACTERISTICS

Sr. No.	Parameter	Unit	Inlet Parameter	Outlet Parameter
1	Design Capacity	m ³ /hr	46	~46
		m ³ /day	1108	1108
2	pH	---	7 – 9	6.5–8.5
3	Temperature	OC	51	≤ 51
4	Total Suspended solid	Ppm	Up to 150	100
5	Total oil	Ppm	10000	< 10

WATER SUPPLY AND WATER TREATMENT

Following is the treatment scheme of Skid Mounted Produce Water Treatment system:



Complete system as above is fabricated, tested and mounted on various skids.

API, TPI & DAF UNITS (OIL REMOVAL SECTION):

Effluent water is first fed into the API separator. Velocity diffusers are provided in the API unit to reduce the velocity of effluent water in the API unit. By reducing the velocity of effluent water, oil and solid particles are separated in API unit. Free oil will float on the surface of the water and suspended solids are settled in the bottom of API separator. Floating oil will be collected by the skim oil pipe and routed to slop oil tank and settled sludge is collected in sludge sump from the bottom of API unit.

Treated water is routed to the TPI unit. In the TPI unit, effluent water is passed through the baffle plates so that the solid particles are settled in the bottom of the TPI unit and effluent water flows from the bottom to upward direction. Oil floats at the top surface of the TPI unit and same will be collected in cut pipe placed on top of the TPI unit. Oil collected in cut pipe is routed to slop oil sump and sludge from the bottom of the TPI unit is routed to sludge sump.

Clarified water will then flow to DAF through a flash mixer and flocculator. In between chemical dosing systems are provided for coagulation & flocculation of suspended solids. From the flocculation tank, effluent water will be routed

to DAF for removal of emulsified oil & suspended solids removal. Sludge will be settled at the bottom of the DAF tank & this sludge will be routed to the sludge sump from the bottom of DAF unit.

WALNUT SHELL FILTERS (POLISHING SECTION):

Clarified water will be collected in the side compartment of the DAF unit. Effluent water will be pumped to Walnut Shell Filter for polishing to meet the required outlet quality in terms of Oil & TSS. To monitor the oil level on a continuous basis online oil analyzer is provided.

From clarified water storage tank treated water is transferred by the clarified water disposal pump to booster pump for re-injection in an oil well.

Modular skid mounted plants, with its inherent advantages, will be a preferred design for all onshore and offshore water and wastewater treatment and reuse packages up to capacity of approximately 1000 m³/day.

About the Author

Dilip R Shukla is the Managing Director of Paramount Limited. Prior to this assignment he held leadership position in several leading Water Infrastructure companies including as Chief Executive – Water & Special Projects SBU of KEC International Limited, He is a mechanical engineer and has done post graduate diploma in Industrial engineering. He has over 38 years of experience of which over 25 years is at the helm in serving Engineering, Process & Infrastructure Industries.

Paramount Limited is India's one of the leading EPC/ DBO players in water and wastewater infrastructure and emission control space with history of pioneering and innovative technologies and landmark projects. Based out of Vadodara, Paramount holds specific leadership position in wastewater treatment and recycling/reuse in oil & gas industry with its over 80 EPC executions in hydrocarbon industry.

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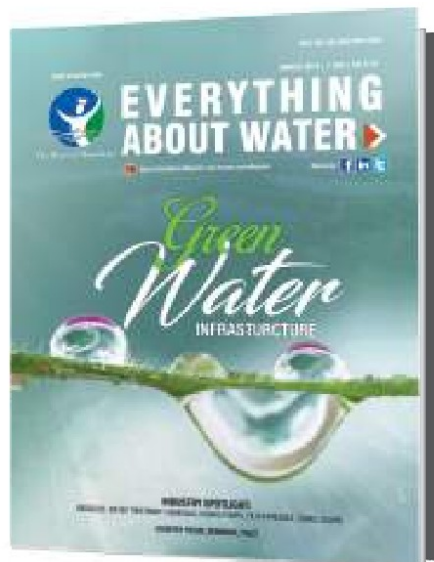
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