

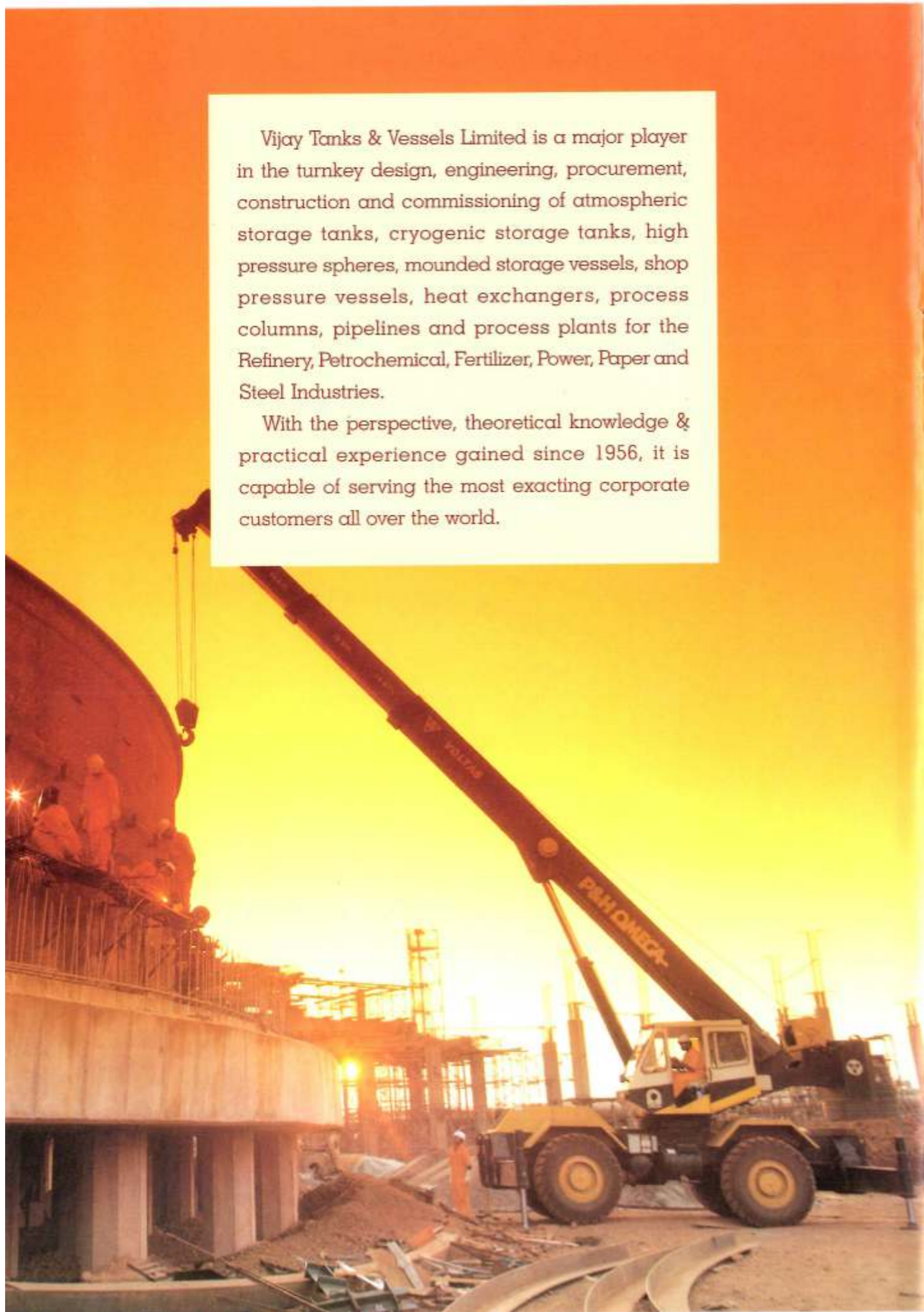
Evolving Ideas - Resolving Challenges



VIJAY TANKS & VESSELS LIMITED



A Cryogenic Ethylene storage facility constructed by VIV using 9% Nickel steel for Finolex Industries, Ratnagiri.



Vijay Tanks & Vessels Limited is a major player in the turnkey design, engineering, procurement, construction and commissioning of atmospheric storage tanks, cryogenic storage tanks, high pressure spheres, mounded storage vessels, shop pressure vessels, heat exchangers, process columns, pipelines and process plants for the Refinery, Petrochemical, Fertilizer, Power, Paper and Steel Industries.

With the perspective, theoretical knowledge & practical experience gained since 1956, it is capable of serving the most exacting corporate customers all over the world.

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A Historical Perspective



R. Ramanujan

The Genesis

Vijay Tanks & Vessels was founded by R. Ramanujan in 1956. R. Ramanujan, and his son R. V. Raghavan, the doyens of the Indian Tankage & Pressure Vessel Industry, developed VTV from humble beginnings as underground diesel storage tank manufacturers to its present position of eminence as a diversified EPC service provider to the Petroleum, Petrochemical, Fertiliser, Steel and Power Industries in India & Abroad.

In the late fifties and early sixties, subsequent to the handling of small mechanical construction assignments, VTV undertook the construction of coastal tankage and pipeline facilities at various locations to facilitate the handling of imported fuel cargo. A major breakthrough came with the discovery of crude oil off the west coast by ONGC. VTV had the privilege of constructing the storage facilities, at very short notice, used for handling India's first tranche of indigenous crude oil. VTV shared this momentous occasion with the country, described by Jawaharlal Nehru, the erstwhile Prime Minister of India, as a major step that would herald the economic independence of the nation.

The Sixties

The 60s witnessed the nationalisation

of oil refining companies and the construction of new refineries to substantially increase the nation's domestic refining throughput. VTV plunged into this national effort with vision and zest. India's first major tankage project for the design and construction of the complete storage facilities for Gujarat Refinery was set in motion by VTV. This involved 110 floating roof and 60 cone roof tanks aggregating to 20000 Mt. of steel fabrication. This project saw VTV charter a new course for the growth and development of Indian Engineering Technology and established VTV as pioneers in the construction of atmospheric storage terminals in India. Over time, VTV established this leadership position by virtue of designing and constructing atmospheric storage tanks of every configuration for a wide array of storage terminals in India and abroad. VTV has on an aggregate designed and constructed over 450000 Mt. of tankages worldwide.

In the early sixties, visualising a growing domestic requirement, VTV established its first fully equipped pressure vessel factory at Bombay followed by another at Madras. VTV's Bombay plant designed and fabricated its first crude distillation column for the Esso Refinery in Bombay which paved the way for VTV's growth as a key manufacturer of critical equipment such as process columns, heat exchangers, pressure vessels, gasholders, silos, and clad & alloy steel vessels for more than 60 grassroot & operating refineries, petrochemical, power, fertiliser and steel plants in India.

In the mid-sixties, VTV met the challenge of designing and constructing India's first ever High Pressure Sphere for Esso's Bombay

Refinery. Since then VTV continues to be the undisputed market leader in India having constructed over 250 spheres in India & Abroad. VTV's construction strengths are manifested by the development of a patented process of spherical tank construction using hydraulic jacks. This system is patented by VTV as the 'Varaha Sphere' and is a global first.

The Seventies

With the growth of Hindustan Steel Ltd. and the establishment of new fertiliser industries, VTV embarked on the development of the design and construction of low temperature and cryogenic storage systems for liquid ammonia, LoX and LiN service. These projects were the earliest domestic efforts in the cryogenic sector and established VTV as pioneers in cryogenic engineering technology for large field storage systems in India.

Visualising the need to build a sustainable growth platform, VTV broadened its vision beyond the Indian shores and forayed into the international arena commencing with a small tankage project for the Kuwait Oil Company in 1974. By the late seventies and early eighties, VTV's design and construction capabilities and project management skills were duly recognised by Global Oil and Gas majors and saw the expansion of international operations to cover the Indian subcontinent, the Middle East and Africa. Some of the overseas projects executed by VTV are as follows:

- An EPC project for an Oil and Gas Storage and Handling Terminal for M/s. Brega Petroleum Marketing Co., Sebha, Libya valued at US\$ 33 million.
- EPC projects for Aviation Turbine Fuel Storage and Handling Terminals for the airports at Kuwait, Nairobi and

Maldives valued at US\$ 12 million.

- An EPC project for an atmospheric storage tankfarm for M/s. JGC, Japan as part of the Mina AlAhmadi refinery modernisation project of KNPC, Kuwait valued at US\$ 17 million.
- An EPC project for a Fuel Oil Storage and Handling Terminal for M/s. Brega Petroleum Marketing Co., Tobruk, Libya valued at US\$ 10 million.
- EPC projects for cryogenic ammonia storage facilities with associated pressure vessels for fertiliser plants in Bangladesh and Sri Lanka.

The Eighties

Whereas the seventies witnessed the emergence of VTV in the turnkey execution of cryogenic LoX/LiN storage systems, the eighties saw VTV develop into an EPC company in the field of large cryogenic storage and handling facilities. During the eighties, VTV handled the design, engineering, procurement, construction and commissioning of an Ammonia Import Terminal for SPIC at Tuticorin and an Ethylene/C2C3 storage facility for IPCL at Nagothane. The Ethylene/C2C3 cryogenic storage tanks were fabricated out of 9% Nickel Steel with design and construction parameters similar to those for LNG storage tanks. VTV has developed and successfully deployed its 9% Nickel submerged arc welding process on all its 9% Nickel Tanks constructed since 1986.

Another highlight of the decade was the completion of Indian Oil's crude oil terminals at Vadinar and Viramgam comprising of 13 nos. 79.5 m dia. X 18 m ht. and 5 nos. 79 m dia. X 14.5 m ht. Double deck floating roof tanks aggregating to a crude oil storage capacity of 1.5 million cu.m. This project firmly established VTV's dominant credentials in the design and construction of crude oil

terminals in India.

Recognising VTV's integrated design engineering, shop manufacturing and field construction competence, IOC entrusted VTV with the design and fabrication of 2 coke chambers of 4.5m dia. X 21.65m ht, with 1 Cr ½ Moly alloy steel for erection in their operating refinery at Gauhati. In the restricted space available around the coking unit, VTV engineered a special EOT crane gantry framework attached to the existing tower of the coker to handle the dismantling and removal of the existing coke chamber and installation of the new chambers. VTV's performance on this critical project merited the renewed appreciation of the discerning domestic refining industry as well as the Indian Institute of Technology who were consulted by the client for evaluation of VTV's erection proposals.

The Nineties

VTV's pressure vessel plants were relocated to Baroda and Jamnagar in the early nineties and continue to service domestic demand for critical shop fabricated equipment. In addition to a high level of automated shop welding systems, the upgraded pressure vessel plants are designed to handle a multiplicity of over dimensioned vessels and columns. Since resitment, a wide variety of pressure vessels and columns have been successfully handled for various Refineries, Petrochemical Plants and Power Industries.

VTV designed and constructed India's largest crude oil terminal for RPL's Jamnagar Refinery consisting of 12 nos. 92m dia. X 20m ht. double deck floating roof tanks aggregating to a crude oil storage capacity of 1.44 million cu.m. This project involved steel fabrication in excess of 40000Mt which was handled within a calendar year and

served to internationally benchmark VTV's credentials in the design and construction of large field erected tanks for crude oil service.

Mounting safety and environmental concerns on aboveground LPG storage systems prompted statutory authorities and Petroleum companies to implement the mounded system of storage for LPG. VTV successfully ventured into this arena by executing the largest EPC mounded storage project in India for GAIL involving 9 LPG/Propane bullets of 6m dia. X 99m length alongwith complete associated facilities required for plant commissioning.

Conclusion

VTV's management, human resource and financial strengths are honed by decades of diverse trans-national experience with a focus on the highest standards of quality, a deep sense of economy and total customer satisfaction. This focus continues to fuel VTV's evolution as a diversified engineering company of world class standards.

The pages of this brochure will convey, in a general way, the range and depth of VTV's capability. Please request for a copy of the Company's Prequalification Document to get a more comprehensive view of the Company's domestic & international track record, infrastructure and operations.



R. V. Raghavan

Complete Engineering, Procurement, Construction & Commissioning services for:

1. Cryogenic & Refrigerated Tanks for LOX, LIN, Ammonia, LPG, Ethylene, Propylene & LNG service
2. Large field erected Floating Roof, Dome Roof, Cone Roof & Internal Floating Roof tanks for storage of crude oil & fluids of all description
3. Pressure Spheres for LPG, Ethylene, Hydrogen, Nitrogen, Ammonia and other Hydrocarbon products.
4. Dry & Wet Gasholders, Silos
5. Process Columns, complete with internals
6. Pressure Vessels & Heat Exchangers - carbon steel, stainless steel, clad steel & alloy steel
7. Mounded Storage Systems
8. Offsite & Process Piping
9. Fired Heaters & Stacks
10. Hot Tapping of Tanks & Pipelines
11. Civil & Structural Works
12. Process Plants



1 Cryogenic Ammonia Import Terminal Tutuohi



2 Atmospheric Storage Terminal JGC Kuwait



3 Pressurized LPG Import Terminal Mangalore



4 Hydrogen Gas holder Hazira



5 Vacuum Columns BPCL Mumbai



6 Heat Exchanger TVV Baroda Factory



7 Mounded Sulfer IOC Gujarat



8 Process Piping Sangamner Refinery & Petrochemical Ltd.



9 Flare Stack Plastic Resins & Chemicals



10 Hot Tapping HPCL Vadod Refinery



11 LPG Boiling Plant & Loading Gantry Brega Libya



12 Crude Distillation unit IOC Gujarat Refinery

Design Engineering



A silo designed and constructed for BIL's PTA plant at Hazira.

VTV's advanced engineering expertise is a central aspect in VTV's status as a world class organisation. VTV's engineering skills are offered with a perspective that encompasses every facet in the project cycle. These include a high level of optimisation in the usage of materials, designs suited to support construction as well as longterm operational requirements and a high level of inbuilt safety & quality features that are possible as a result of VTV's long years of experience and strong design & research orientation.

Evidence of VTV's integrated engineering excellence can be gauged from a brief perusal of VTV's record on major turnkey projects in India & Abroad. VTV offers engineering services from

basic system designs through detailed engineering and commissioning. VTV's multidisciplinary engineering skills include mechanical, civil, electrical, piping and instrumentation work. This diversified range of engineering skills enables us to offer our clients a singular source of responsibility for large and complicated industrial projects where VTV is able to deliver high levels of economy, efficiency and optimisation to help projects get off the ground on schedule with strong inbuilt competitive advantages to our clients.

VTV's extensive experience in all areas of storage and process design is backed by a sophisticated computerised design engineering infrastructure. VTV's design archives hold comprehensive analytical studies of every storage and process equipment covering various international codes. FEA tools are used as a means of research, simulation or review to ensure that VTV designs are zero defect and subjected to the widest array of cross-checks. In-house software programs are constantly developed and updated to cover

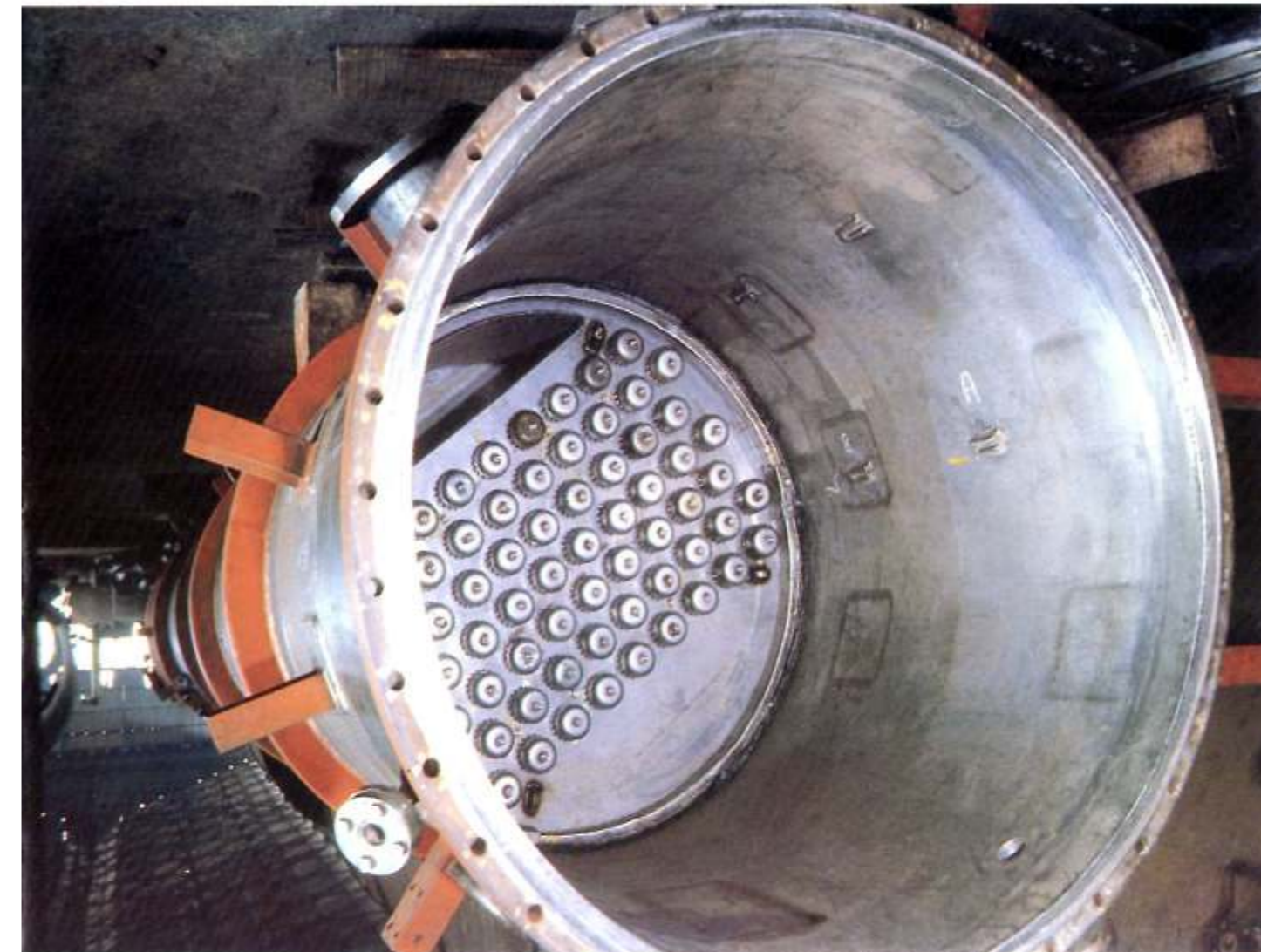
all VTV design work. This is a dynamic evolutionary process at VTV that enables us to maintain our engineering expertise at a cutting edge and systemise the conversion of our experience into value delivered to our clients.

A well equipped CAD infrastructure is used for all draughting work to help reduce the lead time on our engineering assignments. VTV has an established system of engineering execution based on ISO 9001 guidelines to ensure

meticulous adherence to every client and code requirement. At VTV, assimilation, analysis and solutions to every facet in the project cycle begins at the design engineering stage and is thus carried through on a strong technical foundation.

Particular mention must be made here of the technical and management consultancy assignment secured against international competition from the State Establishment of Oil Refining & Gas Industry

(SEORGI), Baghdad which lends credence to VTV's leadership as an internationally reputed engineering company.



A stainless steel recovered solution rectification column with a built in heat exchanger designed and shop manufactured by VTV for Fertiliser Corp. of India, Durgapur.

Quality Assurance

ordination with a central QAQC department that maintains overall responsibility for adherence to a uniform quality standard.

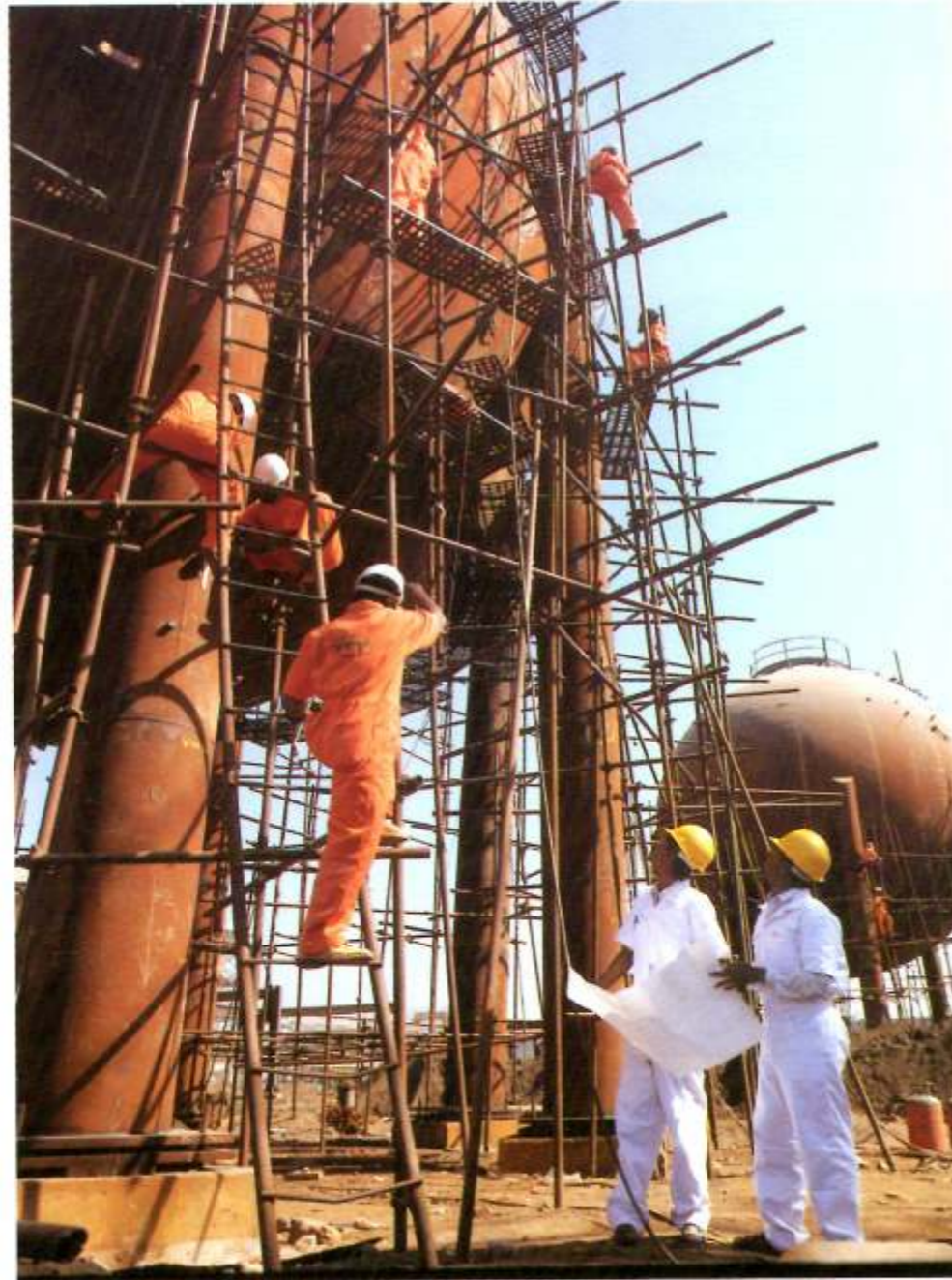
In addition to the inculcation of international quality norms, decades of experience has also enabled VTV to recognise the

unique aspects in the executional process of engineering, procurement and construction work that form the edifice of sustainable quality standards.

This has resulted in the creation of a strong inhouse capability for multi-disciplinary

VTV has a comprehensive Quality systems manual based on ISO 9001 guidelines which define all key work processes to ensure strict adherence to specification requirements at every stage in the lifespan of a contract. This encompasses design, project management, procurement, inspection, construction, testing and commissioning services.

VTV initiates every project by designing safety and quality into the installation and maintains a strong monitoring system during the fabrication, construction and commissioning phase. Every project discipline is covered by a comprehensive quality, inspection and testing plan. Detailed quality control procedures are available to supplement this base document and implemented at all VTV pressure vessel plants and project sites in close co-



VTV's highly trained inspection engineers maintain a meticulous control over all construction activities to help deliver the highest standards of quality.



A turnkey ATF storage terminal designed, constructed and commissioned for KAFPCO, Kuwait. VTV's wide international exposure gives it an edge in terms of perspective in the implementation of quality systems.

engineering work. VTV engineers regularly interact with procurement & field construction personnel to maintain a continual system of feedback that would enable further value addition at the engineering stage. VTV has strong interactive links with domestic and international specialist vendors to enable constant assimilation of modern technology, products and processes. VTV's strong system implementation procedures and computerised networks allow for a systematic and dynamic upgradation of designs based on ground level feedback.

A seamless integration of the engineering, procurement and project management departments enables a multi-skilled unit to bear composite responsibilities for every aspect of a project. This system of working has helped achieve reduced response time to every project requirement with strong controls on every specification or delivery aspect.

VTV has also built up a strong inhouse construction capability of global standards in terms of track record, executional and quality standards, technological prowess and enterprise. VTV commits a very high level of time and effort

towards the maintenance and development of its world class construction teams led by VTV Project Managers who have handled large construction projects worldwide. These construction crews, backed by VTV manufactured critical equipment form the bedrock of dependability for mega-sized industrial projects.

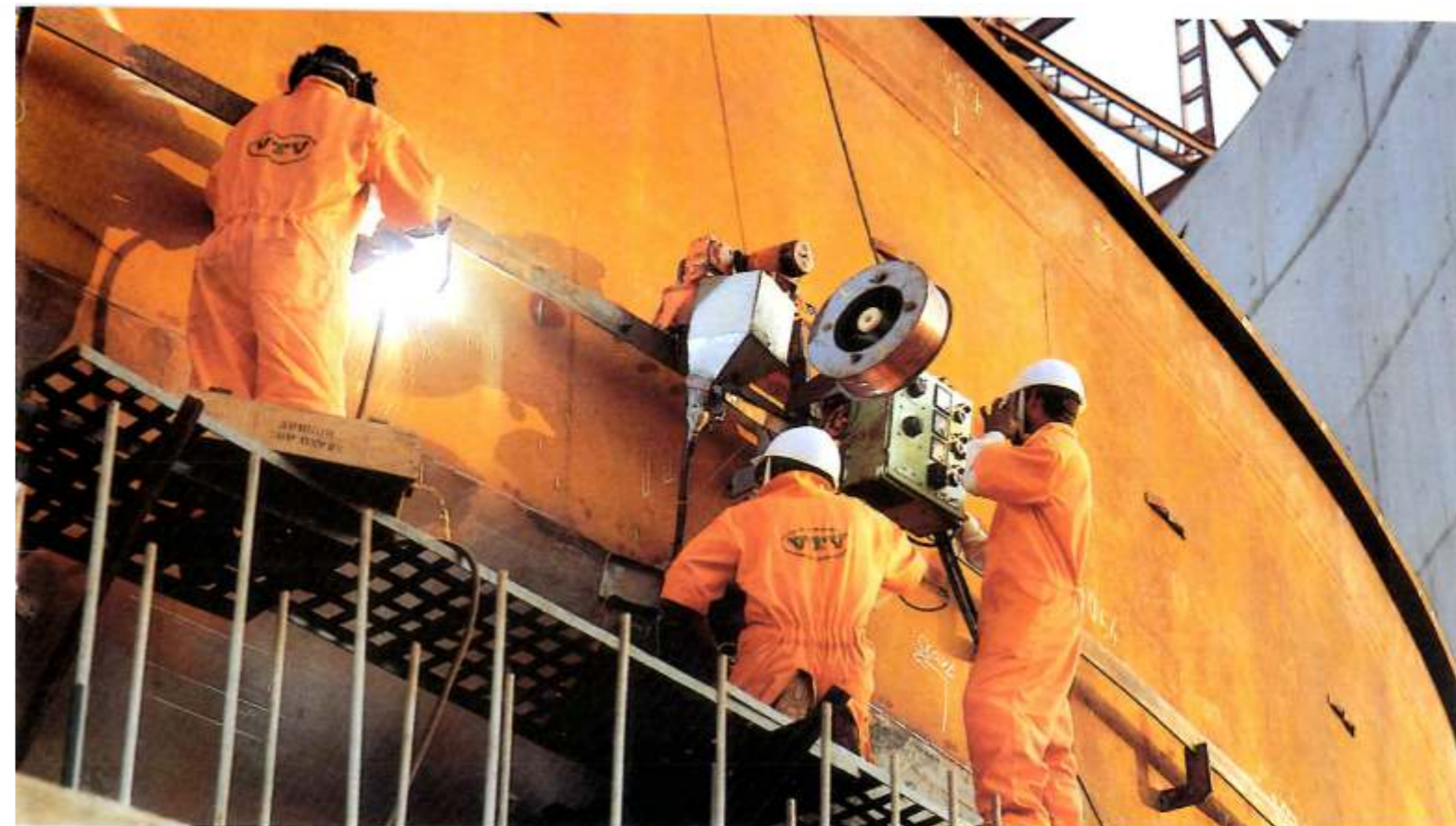
VTV's quality systems are thus built on the edifice of business processes designed and upgraded over decades of invaluable global experience on projects of the most complicated and diverse nature.

Research & Development

The culture of innovation and enterprise at VTV has been sustained by a strong and vibrant research and development wing equipped with an exclusive workshop facility dedicated to the development of prototypes and manufacture of specialised equipment and components. These equipment are designed and developed by VTV engineers, customised based on VTV's specific construction requirements and are amongst the key assets in our endeavour to maintain an international standard of quality and expertise.

VTV today has an inhouse design and manufacturing capability for:

- 1 600T & 1000T Hydraulic Presses
- 2 400A & 600A Welding Rectifiers
- 3 TIG & MIG Welding Machines
- 4 Power Sources
- 5 12T & 20T Hydraulic Jacks
- 6 Bottom & Girth SAW Automatic Welding Machines
- 7 5T-40T Mobile Fabrication Gantry Systems
- 8 Perlite Expanders
- 9 Airlifting Devices
- 10 Positioners
- 11 Swivel Joints for Floating Roof Tank Roofdrains
- 12 Gauge Hatches
- 13 Breather Valves
- 14 Flame Arrestors



VTV's specialised 9% Nickel automatic submerged arc welding expertise benchmarks it against a handful of global cryogenic tankbuilders.

The above equipment encompass every major aspect of the construction process and critical appurtenances for various VTV products and reinforce our commitment towards a high level of excellence in our workmanship.

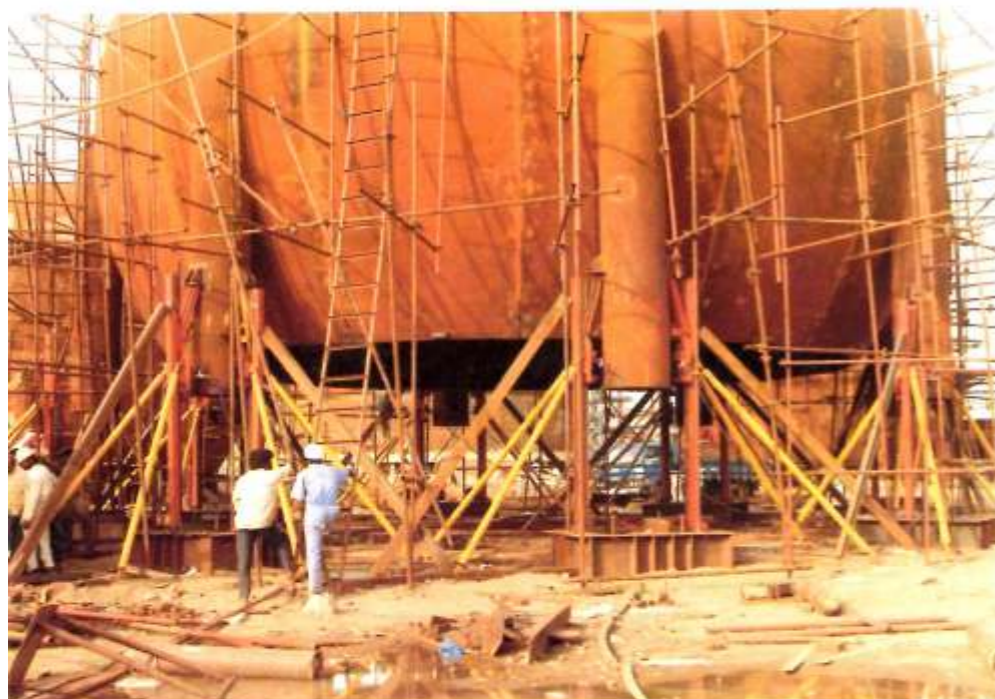
Another highlight of VTV's R&D efforts is the patented process of spherical tank construction adopted by VTV wherein construction work at grade levels has been maximised.

In 1992, VTV's R&D team embarked on a special project for the development of the 'Varaha Sphere'. The 'Varaha' is a character from Indian mythology, manifested as a boar, who lifted the earth from the oceanbed and carried it back to its orbit. This project aimed at

evolving a spherical tank construction process that would similarly enable the progressive construction of a sphere from top-downwards. This would enable assembly and welding work of the entire sphere near grade levels which is of great benefit in terms of quality and safety while accelerating the construction schedule. Once the basic process was designed, extensive computer simulations and stability analyses ensued. After a substantial amount of study the first prototype was successfully tested in 1994 and the world's first hydraulically lifted spherical tank was constructed by VTV in 1995. This is now a VTV patented process and has been appreciated by discerning clients, consultants

and inspectors in the industry.

VTV has developed a strong automatic welding technology expertise since 1972. VTV's automatic welding expertise is deployed on all shop fabricated equipment, atmospheric & cryogenic storage tanks and mounded pressure vessels, enabling achievement of accelerated delivery schedules and an enhanced quality of weldments. This expertise includes 9% Nickel submerged arc welding used on Ethylene, C2C3 and LNG tanks - a highly specialised skill deployed by a handful of cryogenic tankbuilders globally.



A spherical tank being built by VTV's unique and patented "Varaha" process of construction.

Projects Execution

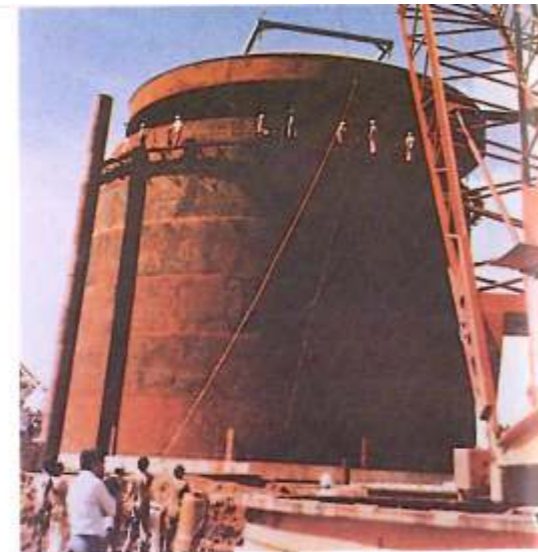
VTV's project execution philosophy involves deployment of a 'task force' which handles the implementation of a variety of functions ranging from site survey, planning, design, procurement and construction to commissioning and handover. The related project management activities such as project planning, schedule control, cost control and quality control are thus performed under unified concepts.

A basic project execution program is drawn up at the initial stage to familiarise executional personnel with client requirements. Detailed project schedules are prepared by the

task force using sophisticated software programs that enable the simultaneous processing of a very large multitude of activities in an integrated fashion.

Equipment and material costs, manhour projections and mobilisation efforts are stringently assessed in line with contractual specifications and basic engineering design data to ensure that construction costs are within the allocated budget. A balanced system of cost control is carried out with due consideration to the interrelation between schedule and quality/safety.

Interface with the client, subvendors and inhouse specialist departments is



A dome roof with compression ring under final erection for a 3000 Mt. Double Integrity Ammonia Storage Tank handled by VTV on a turnkey basis for the State Fertiliser Manufacturing Co., Sri Lanka.

maintained in a standard and precise fashion to enable thorough coordination and accurate flow of information which are vital aspects in the successful execution of projects. Efficient supply chain management techniques are adopted to serve as an essential tool in maximising value to our

clients on large EPC projects and ensuring speedy response to every project requirement.

VTV's on schedule track record and innovative construction schemes are a result of a well structured organisation that has handled a variety of storage terminal and process plant engineering and construction work in India and enjoys a very strong performance record in the international market. Our project execution teams offer world class levels of professional service backed by a reference list that has helped fashion VTV into a globally reputed organisation within its sphere of activity.



A 60 LPG tank wagon unloading gantry designed and constructed as part of a turnkey LPG storage and handling facility delivered by VTV to Salem Steel Plant.

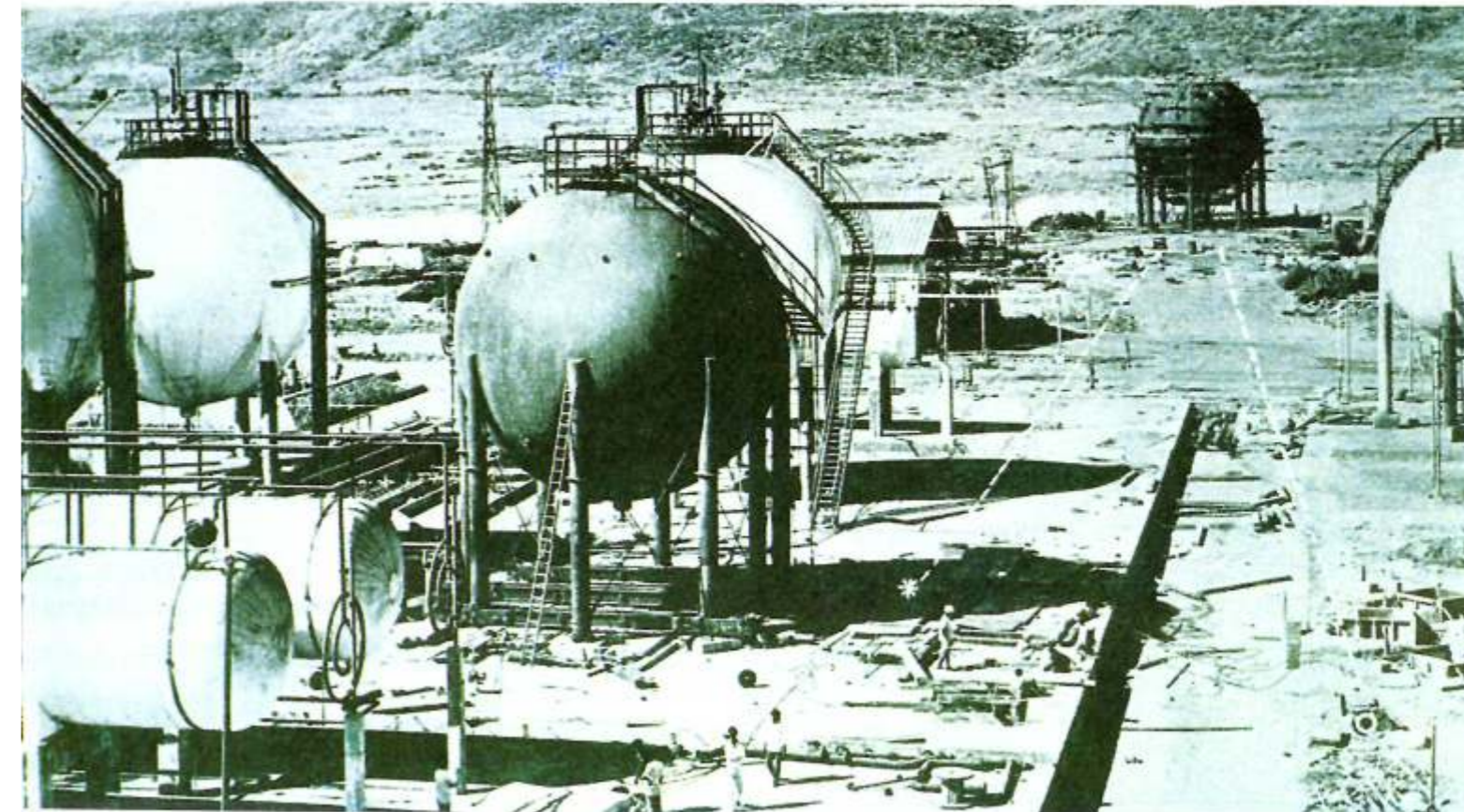


A covered mobile fabrication gantry temporarily installed by VTV at the worksite for handling 9% Nickel Steel prefabrication of 4 nos. ethylene cryogenic storage tanks for Finolex, Ratnagiri.

An Ethylene sphere (unpainted) constructed at a distance and hauled to its permanent position at NOCIL's running petrochemical plant. A propylene sphere under construction at a distance awaiting haulage into the running plant.



Stainless Steel Silo subassemblies under final erection at a petrochemical complex. VTV's diversified product portfolio enables it to provide single point responsibility for a wide range of services on large industrial projects.



Turnkey Projects



A Pilot Distillation Plant engineered and constructed by VTV for Gujarat Refinery to process feedstocks for producing speciality products.

VTV has executed turnkey projects for almost every major domestic and international Oil & Gas Company. VTV references include turnkey projects for more than 300 atmospheric, cryogenic & pressurised storage tanks and process plants including a variety of columns, heaters, heat exchangers and pressure vessels along with all associated civil, piping, electrical and instrumentation works. We highlight herewith a few such projects.



A diversified industrial project wherein VTV supplied a wide range of storage tanks, process column heat exchangers, gasholders and flare stacks.

- **Oil & Gas Installation :** VTV has handled the turnkey execution of a petroleum and gas installation at Sebha for the Brega Petroleum and Marketing Co. This project involved basic and detailed design engineering, procurement, construction and commissioning of complete atmospheric and pressurised storage systems for LPG, Kerosene, Naphta & Lube Oil, pumping facilities, an LPG bottling plant, total terminal electrification and instrumentation, a 2.6 km road network, 22000cu.m. of concreting work, a central control room with computer control systems for the entire facility, fire and foam systems, telephone, public address and wireless paging systems and 750 sq.m. carpet area of



A US\$ 33 million Petroleum & Gas Installation handled by VTV on an EPC basis in Libya, involving complete terminal facilities.

administrative and sales office facilities.

- **Crude Distillation Unit:** VTV has handled the construction of a crude distillation unit for a 3 million TPA refining unit of Gujarat Refinery including crude and vacuum heaters with alloy steel pipework and refractory lining, 5 process vessels, 4

distillation columns, piping and chimneys, heat exchangers and 110 kms. of yard and process piping.

- **Aviation Turbine Fuel Storage & Handling Facilities:**

VTV has handled a multitude of large turnkey atmospheric storage projects. These include an ATF storage and handling facility at Kuwait airport which included jet fuel and fire water storage tanks, tank foundations, plant drainage systems, RCC bundwalls and roadworks, a pumphouse with installation of control instrumentation to automatically regulate the delivery of fuel into the airport hydrant system according to demand, interconnecting pipework, area lighting and power distribution for the pump drive units.



VTV pioneered the EPC execution of 9% Nickel Tanks in India with a 23000 Mt. cryogenic storage terminal for IPCL's Nagothane Petrochemical Complex.

- **Ethylene/C2C3 Cryogenic Storage Terminal:** VTV pioneered the EPC execution of 9% Nickel cryogenic tanks for ethylene/C2C3 storage in India in 1986 for IPCL involving complete engineering, procurement, construction and commissioning of 2 nos. 6000cu.m. Ethylene storage double wall cryogenic tanks and 2 nos. 13000cu.m. C2C3 storage double wall cryogenic tanks including base heating systems, intank pumps, instrumentation systems, air heated vapourisers and fire protection systems.



A Crude Distillation Unit constructed by VTV for a 12mtpa Oil Refinery in Gujarat.

- **Pilot Distillation Plant:** VTV has handled the detailed engineering and construction of a pilot distillation facility for Gujarat Refinery consisting of Fired Heaters, heat exchangers, storage tanks and process equipment including buildings, civil foundations, piping, electrical and instrumentation work. This facility was utilised to

process feedstocks for producing speciality products.

- **Ammonia Storage, Refrigeration and Handling Facilities:**

VTV has handled the total design, engineering, procurement and construction of a cryogenic Ammonia Import Terminal consisting of a 10000Mt. double walled ammonia storage tank, a 3.5km. 16"NB unloading pipeline, a refrigeration system comprising of two screw compressors, a holding compressor, intercoolers,

condensers, receivers, inlet pumps and interconnecting pipelines, 2 ammonia transfer pumps with all accessories and an ammonia heater.

- **Cryogenic LoX Storage & Handling Facilities:**

VTV has handled a turnkey contract for Kerala Minerals & Metals Ltd., Quilon which involved the design, engineering, procurement, construction and testing of 1 no. 100Mt capacity each double wall spheres with evacuated powder insulation for liquid oxygen and liquid nitrogen service along with pump out and vapourising facilities.

- **Diversified Industrial Project:**

VTV's diversified engineering, procurement, shop manufacture and field erection skills were demonstrated on a large and intricate industrial project for Plastic Resins and Chemicals Ltd. wherein VTV's involvement included 2 nos. spheres



Filter Water Separators as part of a Aviation Fuelling Facility provided by VTV at Hulule, Maldives.

specially designed for inert gas storage, 4 nos. wet seal gasholders of single and double lift, 5nos. distillation columns, 5 nos. process towers, flare stack, air intake stack, acid purge stack, 18 heat exchangers, 72 pressure vessels, 5 nos. floating roof tanks, 12 nos cone roof tanks and a hot well. A major part of the project was handled out of VTV's pressure vessel concurrently handling field construction work and equipment erection of all shop fabricated equipment.

- **Pressurised LPG Storage & Handling System:**

VTV has handled the engineering,



India's largest LPG mounded storage terminal designed, constructed and commissioned by VTV for The Gas Authority of India Ltd., Patna.

procurement and construction of an LPG storage and handling facility at Salem Steel Plant comprising of 3 spheres, a railway unloading gantry equipped to receive 60 rail tank wagons, 6 lpg compressors with interconnected piping, aftercoolers to achieve unloading of liquid and vapour,

steam heated vapourisers for delivery of liquid to the main plant alongwith all related civil, electrical and instrumentation work required to operate the facility.

- **Mounded LPG Storage & Handling System:**

VTV has handled the design, engineering, procurement, construction and commissioning of the largest mounded storage LPG terminal in India for the Gas Authority of India Ltd. which included total mechanical and civil work for nine mounded bullets aggregating to 25000cu.m of LPG and propane storage, product pumping facilities and odourant system packages, plant electrification, instrumentation, complete inplant piping, cathodic protection systems and residual civil works comprising roads, drains, culverts, enabling structures and pumphouse & odourant sheds.



Gaseous Oxygen Vessels provided as part of a turnkey cryogenic storage and handling facility designed and constructed by VTV for Bilhat Steel Plant.

Cryogenic Storage Tanks

VTV references include more than 45 cryogenic tanks of single wall and double wall configuration using carbon steel, aluminium alloy steel, stainless steel and 9% Nickel steel along with handling, refrigeration and vapourising facilities for a wide variety of service conditions. VTV designed and constructed its first cryogenic storage terminal in 1972 for the Rourkela Steel Plant. This project involved the design, procurement, fabrication, erection, testing and commissioning of a 1000Mt. Liquid Oxygen Tank, four 100cu.m. gaseous oxygen vessels, liquid and gaseous oxygen filling and transfer lines. The liquid oxygen was stored at -183deg.C in a 12m dia. Aluminium alloy sphere suspended within a steel container holding expanded perlite insulation in a dry inert atmosphere. A very



After completion of the outer tank top shell course, dome roof and suspended deck of this 9% Nickel Tank, hydraulic jacks were used to progressively lift and construct the tank to its final position with all work being handled at grade level.

sophisticated instrumentation system was designed for the facility to ensure a safe operation. VTV's R&D department successfully developed inhouse MIG welding machines for carrying out aluminium alloy welding on this LoX tank and portable field units for expanding the perlite ore - 35 million cu.cm of ore was expanded to 20 times its volume - for filling the annulus of this tank. VTV subsequently handled the engineering, procurement and construction of a LoX storage and handling facility for the Bhilai steel plant including a 2000Mt Lox tank, lox intake pipework, lox pumpout facilities, a steam heated vapouriser and

electrical & instrumentation works for the storage plant operation. VTV Lox and LiN terminals are in service in a large number of steel and petrochemical plants in India. Concurrently, the growth in the fertiliser industry in the Indian subcontinent provided opportunities for VTV to handle the engineering, procurement and construction of refrigerated ammonia storage terminals for an array of Fertiliser Corporations in India, Bangladesh and Sri Lanka. VTV's involvement in providing indigenous expertise for cryogenic storage facilities to the steel, petrochemical and fertiliser industry during their early years of growth and development form the bedrock of VTV's cryogenic engineering and construction credentials. In the mid-eighties, VTV pioneered the EPC execution of an Ethylene/C2C3 cryogenic storage terminal for IPCL consisting of 4 nos. 9% Nickel storage tanks. This project heralded a new phase of growth for the company in the cryogenic

sector which resulted in the execution of a range of projects for the storage of Ethylene, Propylene and C2C3 for India's petrochemical industry. VTV has specialised in the construction of double wall tanks by hydraulic jacking. Having

constructed 12 tanks of 9% Nickel, VTV has also developed a substantial 9% Nickel fabrication and welding experience both by the SMAW and SAW process.



2 nos. 9% Nickel cryogenic double integrity ethylene tanks constructed for GAIL's Pata Petrochemical Complex.

A FEW VTV CRYOGENIC STORAGE TERMINAL PROJECTS

S.No.	Client	Type of Tank	Service	Capacity (Mt)	MoC	Qty
1.	Bokaro Steel Plant,	Double Wall Dome Roof	Liquid Oxygen	2000	Aluminium Alloy & Carbon Steel	1
2.	Ashuganj Fert. & Chem. Co., Bangladesh	Double Wall Dome Roof	Ammonia	10000	BQ Steel	1
3.	RIL, Hazira	Double Integrity Dome Roof with Suspended Deck	Ethylene & Propylene	10000	9% Nickel & 1% Nickel	3
4.	IFFCO, Kalol	Single Wall Dome Roof	Ammonia	10000	BQ Steel	1
5.	GAIL, Pata	Double Integrity Dome Roof	Ethylene	4500	9% Nickel	2
6.	Essar Steel, Hazira	Double Wall Dome Roof	Liquid Oxygen	500	Stainless Steel	2
7.	IPCL, Nagothane	Double Integrity Dome Roof with suspended deck	Ethylene & C2C3	3500 & 8000	9% Nickel	4
8.	Finolex, Ratnagiri	Double Integrity Dome Roof with suspended deck	Ethylene	10000 & 6000	9% Nickel	4
9.	Cochin Fertilisers,	Double Wall Dome Roof	Ammonia	10000 & 5000	BQ Steel	2

A 15000 cu.m. single wall insulated ammonia storage tank designed and constructed by VTV for GNFC, Bharuch. The dome roof was constructed at grade level and air raised to its final height. VTV has a very strong experience record in the turnkey execution of Ammonia Storage Terminals in India.

VTV has handled cryogenic double walled spheres for KMMIL for LoX and LiN storage, the only such spherical cryogenic storage facility in India.



The outer tank dome roof and suspended deck of a cryogenic propylene storage tank constructed for RIL, Hazira.



High Pressure Spheres

VTV's credentials in the design and construction of spherical tanks include more than 250 pressurised and cryogenic spheres for LPG, ethylene, C2C3, propane, butane, nitrogen, LoX, LiN, hydrogen, inert gas and ammonia service in India & abroad since 1964. This

performance slots it amongst the leading sphere manufacturers in the world.

VTV has pioneered the design and construction of pressure spheres in India and continues to drive international spherical tank technology through the creation of patented construction processes and use of computer simulation tools to arrive at more economical sphere designs. VTV spheres are designed to provide superior levels of integrity, economy and safety through the application of well researched petal fabrication technologies.

VTV's 'Varaha Sphere' is

constructed by a unique patented process involving the phased tier-wise construction of the tank from top downwards to enable construction work to proceed as close to grade levels as possible. This system has merited the appreciation of clients, consultants and third party inspection agencies and underlines VTV's commitment towards continual evolution and improvement.

VTV has inhouse capability for field stress relieving of large spherical tanks. VTV owns mobile stress relieving units with automated controls to help provide a well controlled heat

An EPC project for a LPG storage terminal consisting of 7 spheres handled for IOC's Panipat Refinery Project.



A 23000 cu.m. LPG storage terminal, amongst India's largest, designed and constructed for Essar Oil's Jamnagar Refinery.

treatment operation. VTV's bank of heavy duty hydraulic presses are capable of cold pressing plates upto 85 mm thick. VTV's mobile fabrication gantry

systems equipped with hydraulic press facilities, prepinching and plate bending machines, EOTs from 7.5 Mt. to 15 Mt. capacities and all residual equipment are

mobilised for the field fabrication of large spherical tank installations.

A FEW VTV SPHERICAL TANK TERMINAL PROJECTS

S.No.	Client	Dia. (m)	Thk (mm)	Design (kg/sq.cm.)	Pressure	Service	Qty.
1.	Kerala Minerals & Metals Ltd., Cochin	5.8	5	Cryogenic Double Walled with Vacuum Insulation and stainless steel		Liquid Oxygen & Liquid Nitrogen	2
2.	Brega Petroleum, Libya	11 - 14.5	35 - 40	14		LPG	6
3.	Essar Oil Ltd., Jamnagar	10.5 - 19	48 - 73	20 - 45		LPG & Hydrogen	15
4.	RIL, Hazira	14.5 - 21	22 - 68	14.5 - 24		Ethylene & Propylene	8
5.	Atomic Energy Power Project, Madras	9.5	30	12		Nitrogen	1
6.	National Fertilisers Ltd., Bhatinda	17	32	6.5		Liquid Ammonia	2
7.	IOC, Panipat	14.5	48	14.5		LPG	7
8.	SCOP, Iraq	14	38.1	14		Propane & Butane	3
9.	Hindustan Steel Ltd., Rourkela	12.57	5	Cryogenic Double Walled with perlite insulation and aluminium alloy steel		Liquid Oxygen	1

Atmospheric Storage Tanks

VTV references include over 2000 oil and product storage tanks worldwide - which reinforce its credentials as a tankbuilder of global standards. VTV has designed and constructed double deck floating roof tanks for more than 70% of India's crude oil storage capacity.

VTV has a global size tankage construction equipment and field crew resource and its inhouse equipment design and manufacturing capability lend great flexibility towards its equipment pool enhancement, maintenance and rehaul. All components and appurtenances

of floating roof tanks, including critical roofdrain swivel joints, breather valves, flame arrestors and gauge hatches, are specially designed and manufactured inhouse and supplied by VTV. Bottom and Horizontal submerged arc welding equipment designed and manufactured by VTV are used for handling 80% of welding work on storage tanks. This helps guarantee high quality weldments on VTV tanks at reduced delivery schedules.

VTV has a vast experience record in the air lifting of large double deck floating roofs and dome roofs weighing upto 850 Mt. VTV's airlifting units with a central control panel are specially designed to facilitate a precisely controlled operation

with back-up power arrangements to ensure safety. VTV has developed inhouse computer programs for every aspect of atmospheric storage designs including structural analyses of oversized double deck roofs and truss cone roofs. VTV has inhouse expertise for the stress relieving of storage tanks for sour service. This is a unique operation involving resolution of a host of heat transfer and tank distortion problems. VTV engineers have developed special designs that take into consideration every aspect of the tank heat treatment cycle and subsequent tank service condition requirements while executing the stress relieving operation.

A global scale crude oil tankfarm designed and constructed by VTV for RPL's Jamnagar Refinery comprising of 12 nos. 92 m dia. X 20 m ht. double deck floating roof tanks.



A turnkey Petroleum Storage and Handling Terminal executed for Kenya Pipeline Co. Ltd., Nairobi involving complete storage and pumping facilities along with all civil, electrical, instrumentation and piping work.

A FEW VTV ATMOSPHERIC STORAGE TERMINAL PROJECTS

S.No.	Client	Type of Tank	Dia (m)	Ht (m)	Service	Qty
1.	Petramin, Jeddah Airport Terminal, Saudi Arabia	Covered Internal Floating Roof	70	20	Petroleum Oil	6
2.	RPL, Jamnagar	Cone & Floating Roof	10 - 92	10 - 20	Crude Oil & other Petroleum Products	32
3.	Haldia Fertiliser Project	Stainless Steel Dome Roof	11.3	7.5	Nitric Acid	2
4.	KNPC, Mina Al Ahmadi Refinery	External/Internal Cone & Floating Roof	6 - 58	7 - 20	Various Petroleum Products	26
5.	IOC, Vadinar	Floating Roof	79.5	18	Crude Oil	13
6.	Kenya Pipeline Co., Nairobi	Cone, Dome & Floating Roof	12 - 50	15 - 20	Various Petroleum Products	22
7.	SCOP, Iraq	Cone & Floating Roof	12 - 68	10 - 20	Various Petroleum Products	34
8.	IOC, Virangam	Floating Roof	79.5	14.5	Crude Oil	5
9.	IOC, Haldia Refinery	Cone, Dome & Floating Roof	12 - 70	8 - 12	Crude Oil & other Petroleum Products	95

Pressure Vessels & Process Equipment

VTV references include more than 1000 shop fabricated pressure vessels and fixed/floating head heat exchangers and over 75 process columns for the refinery, petrochemical, power and fertiliser sectors in

India and abroad since 1963. VTV's pressure vessel plants in Baroda and Jamnagar are equipped with modern equipment and strong engineering, manufacturing and quality control teams to provide high quality service for a wide variety of shop fabricated equipment.



Site assembly at RCF, Bombay of a VTV shop fabricated Benfield Regenerator and Benfield Absorber.

VTV SHOP MANUFACTURING FACILITIES

Total Area	1300000 sq.ft.
Covered Area	175000 sq.ft.
Maximum thickness of plates which can be rolled	75 mm
Maximum thickness which can be dished or formed	100 mm
Maximum thickness which can be welded and radiographed	100 mm
Maximum lifting capacity	150 Mt
Maximum size vessel which can be stress relieved	8 m dia. X 25 m long
Type of materials which can be fabricated and welded	Carbon Steel, Low Alloy Steel, Stainless Steel, Clad Steel, Aluminium, Aluminium Alloy and Non-ferrous Metals
Type of welding which can be done	Manual Shielded Metallic Arc Welding, Gas Welding, Automatic Submerged Arc Welding, Metallic Inert Gas Welding & Tungsten Inert Gas Welding
Codes of Construction	ASME Sec. VIII Div. I & II, BS 1500, BS 1515, BS 5500, BS 2594, BS 2654, API 620, API 650, TEMA, AD Merkblatter & IS Codes
Type of Heads Manufactured	Elliptical, Torispherical and Hemispherical
Maximum size of vessel transportable	8m dia. X 25m long or 3m dia. X 50m long
Method of edge preparation	Carbon and Low Alloy Steel by oxy-acetylene flame cutting followed by grinding, Stainless Steel and Aluminium by plasme arc / shearing / arc air cutting followed by grinding
Testing	Gamma Ray, X-ray, Magnetic Particle, Wet Fluorescent Magnetic Particle, Ultrasonic, Dye Penetrant, Impact, Hardness, Tensile, Elongation, Bend, Chemical, Pneumatic, Vacuum, high pressure/ high speed hydrostatic
Tube Expansion	Pneumatic, hand operated and electric torque controlled tube expanders



A 5.9 m diameter LPG bullet under final stages of fabrication at VTV's Baroda Pressure Vessel Factory. VTV's plants are designed to handle a multiplicity of overdimensioned vessels.

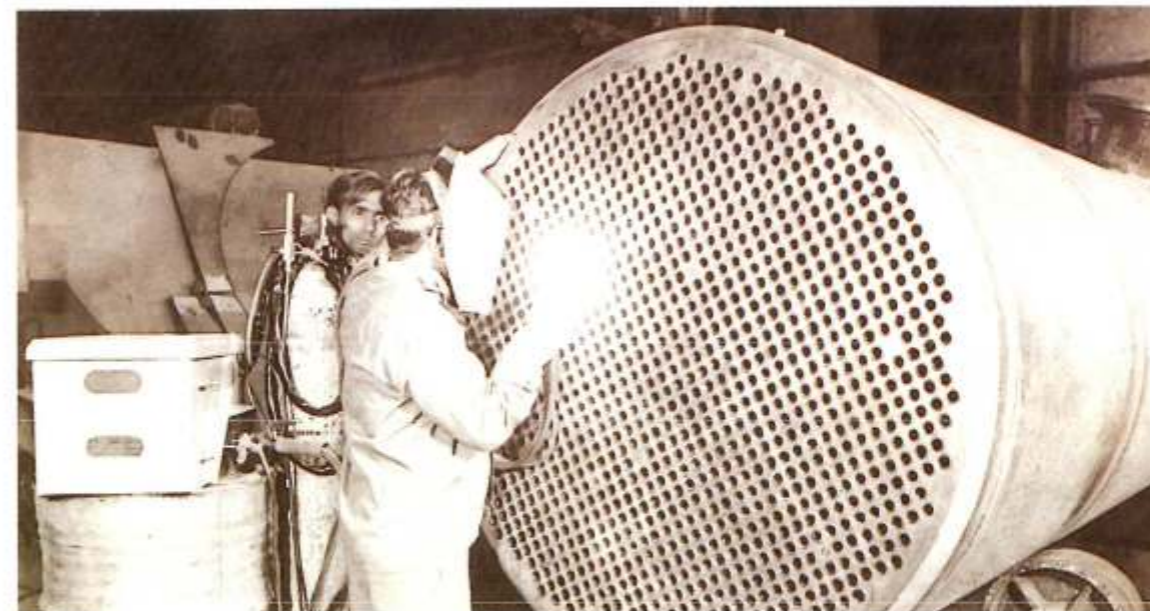
A FEW SHOP PRESSURE VESSEL ORDERS EXECUTED BY VTV

S.No.	Client	Equipment Description	Dia. (m)	Ht. (m)	Wt. (Mt)	MoC	Design Code
1.	IOC, Gujarat Refinery	LPG Bullets	5.9	64	330	A 537 Cl.1 BQ Steel	BS 5500
2.	Merck Sharp & Dohme of India Ltd.	High Pressure Jacketted Autoclave Vessel	3.02	5.8	17.5	A 240 TP321 Stainless Steel	ASME Sec.VIII Div.I
3.	Bechtel, Dabhol Power Plant	Hot Reheat Steamline Drain Tank	1.2	2.97	12	A 387 22 Cl. 2 Chrome Moly Steel	IBR 1950
4.	Bhabha Atomic Research Centre	H.T.Shift Converter	1.6	5.5	8	A 204 Gr.B Carbon Moly Steel	ASME Sec.VIII Div.I
5.	National Fertilisers Ltd, Bhatinda	Scrubber Effluent Knock Out Drums	1	4	6	A 516Gr.70 + A 240 TP 321 Clad Steel	ASME Sec.VIII Div.I

A FEW PROCESS COLUMN ORDERS EXECUTED BY VTV

S.No.	Client	Equipment Description	Dia. (m)	Ht. (m)	Weight (Mt.)	MoC	Design Code
1.	IOC, Gujarat Refinery	Vacuum Column	6.4	35	81	A 515 Gr. 60 + A 240 TP 316 L Clad Steel	ASME Sec.VIII Div.I
2.	Esso Refinery, Bombay	Crude Distillation Column	5	52	240	A 516 Gr.70	ASME Sec.VIII Div.I
3.	IPCL, Baroda	Paraffin Column	4.75	40	90	A 516 Gr.70	ASME Sec.VIII Div.I
4.	Essar Oil Ltd.	Orifice Chamber for an FCC Unit	2.4	19.4	29	A 516 Gr.70 with SA 240 304H internals	BS 5500
5.	Polychem Ltd., Bombay	Distillation Tower with bubble cap trays	2.6	47	95	A 285 Gr. C	ASME Sec.VIII Div.I
6.	Rashtriya Chemicals & Fertilisers Ltd., Bombay	Benfield Regenerator	4.75	48.7	95	A 516 Gr.65	ASME Sec.VIII Div.I
7.	Fertiliser Corporation of India, Trombay	Distillation Tower	1.05	41	22	A 240 TP 316	ASME Sec. VIII Div.I
8.	NFL Bhatinda & Panipat	HCN Strippers Column	1.8	25	30	A 240 TP 321 Stainless Steel	ASME Sec.VIII Div.I
9.	GNFC, Gujarat	Distillation Column	1.4	38.8	25	A 240 TP 304L	ASME Sec.VIII Div.I

A stainless steel HCN stripper Column designed and manufactured by VTV for National Fertiliser Ltd.'s Bhatinda Plant.



A stainless steel stationary head fixed tubesheet expanded tube exchanger for ammonia condenser service under fabrication at VTV's Pressure Vessel Factory.

A FEW HEAT EXCHANGER ORDERS EXECUTED BY VTV

S.No.	Client	Equipment Description	Shell MoC	Tubesheet MoC	Dimensions (dia x long)m	Weight (Mt)	Design Code
1.	Heavy Water Project, Baroda	First Feed Water Heater - Stationary Head Floating Tubesheet	A 515Gr.70	A 181 Gr.2 + A 240 Type 304L	0.55 X 3.676	3.11	Tema Class C/IBR
2.	Madras Refineries Ltd., Manali	Compressor After Cooler - Three Stage Floating Head Heat Exchanger	A 515Gr60	A 213TP316L	0.5 X 4.869	12	TEMA Class 'R' & ASME Sec. VIII Div. I
3.	FCIL, Trombay	M. P Decomposer - Double Pass Floating Tubesheet Expanded Tube Exchanger	A 515Gr60	A 213TP316L	2 X 15	25	Tema Class C
4.	Heavy Water Project, Baroda	Ammonia Condenser - Stationary Head fixed tubesheet, expanded tube exchanger	A 516 Gr.70	A 213 TP 304	1.11 X 8.4	15	Tema Class C / IBR
5.	Fertiliser Corp. of India, Durgapur	Recovered Solution Rectification Column with built-in Exchanger	A 240TP316	A 213TP316	1.58 X 15	25	TEMA Class 'C' & ASME Sec. VIII Div. I

A process column under despatch from VTV's Jamnagar plant for RIL's Jamnagar Petrochemical Complex. VTV's manufacturing facilities have handled a wide range of process columns for the refinery, petrochemical and fertiliser industries since 1963.



Mounded Storage Vessels

The mounded system of LPG storage provides numerous advantages in terms of safety and environment factors. In view of the tremendous growth in domestic LPG consumption, the creation of storage terminals across the country to enable safe handling, storage and distribution of LPG is an issue of primary importance. VTV's integrated engineering skills on mounded storage systems offer tremendous value to clients in

terms of an optimisation in the total facility as a whole. VTV's long years of pressure vessel fabrication and rigorous quality procedures help ensure the efficient and trouble free service of all VTV mounded installations.

VTV's credentials on mounded LPG storage have been established on India's largest terminal handled on an LSTK basis for the Gas Authority of India Ltd. at their Pata Petrochemical Complex. This project involved 9 nos. 6 m dia. X 99 m lg. LPG/Propane bullets on two mounds alongwith complete pumping, civil, piping, electrical, instrumentation and

cathodic protection facilities to operate the plant.

VTV's Baroda Pressure Vessel plant has also handled the shop manufacture of 3 nos. 1800cu.m. bullets for IOC's Gujarat Refinery. These vessels were manufactured on the shopfloor with the deployment of rambroom welding machines to facilitate an 80% automatic welding coverage. The vessels were fabricated in 3 segments, shop stress relieved and subsequently transported to site for final erection using custom built A-Frames mounted on the sandbed.

A FEW VTV MOUNDED STORAGE TERMINAL PROJECTS

S.No.	Client	Diameter (mts)	Length (mts)	Thickness (mm)	Service	Qty.
1.	GAIL, Pata	6	99	24	LPG	7
2.	GAIL, Pata	6	99	32	Propane	2
3.	IOC, Gujarat	5.9	64	26	LPG	3
4.	BPCL, Loni	7	79	30	LPG	3

VTV has handled the turnkey implementation - from basic design to commissioning - of a 25000 cu.m. mounded lpg storage terminal for GAIL's Pata petrochemical complex.

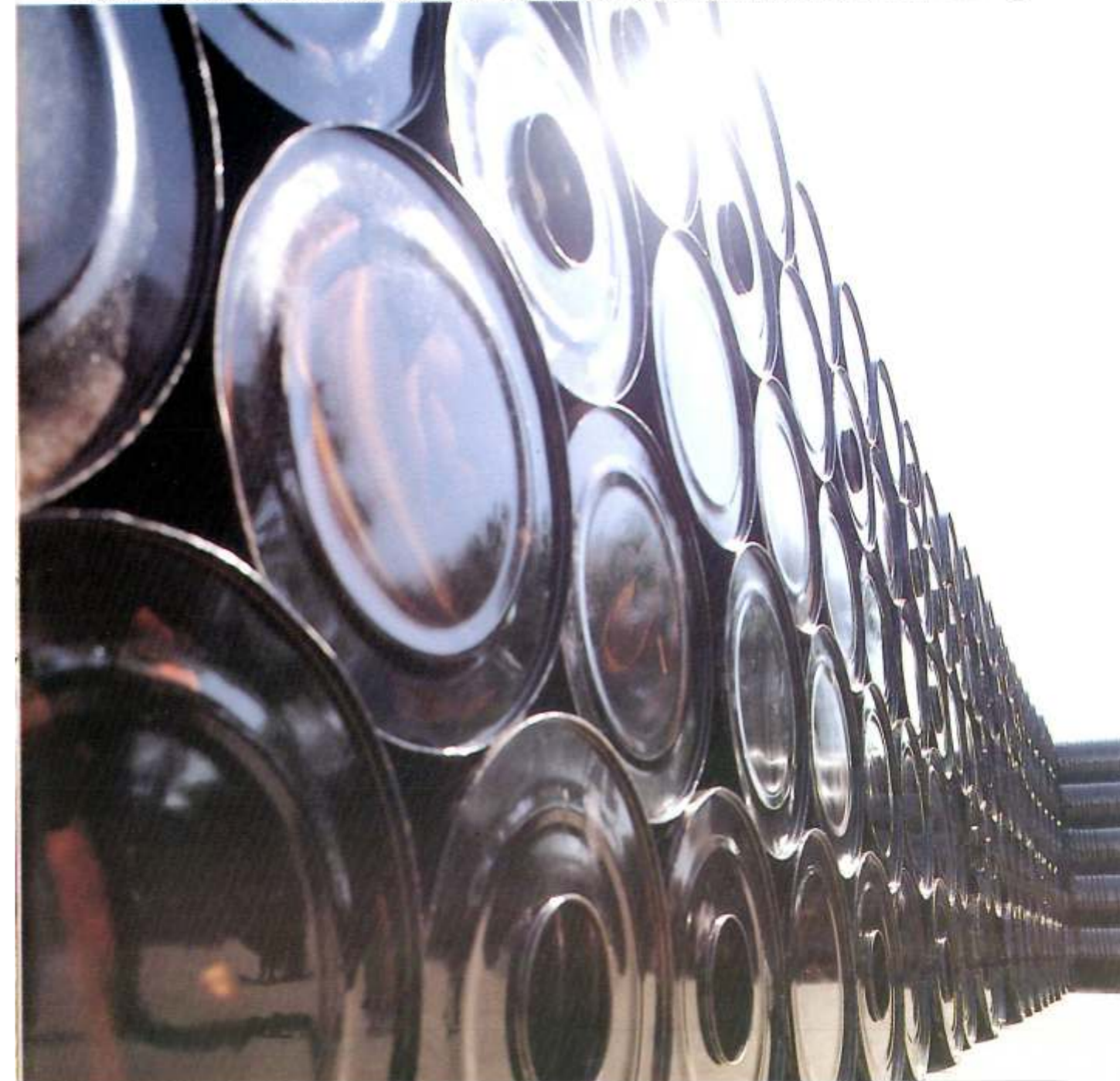


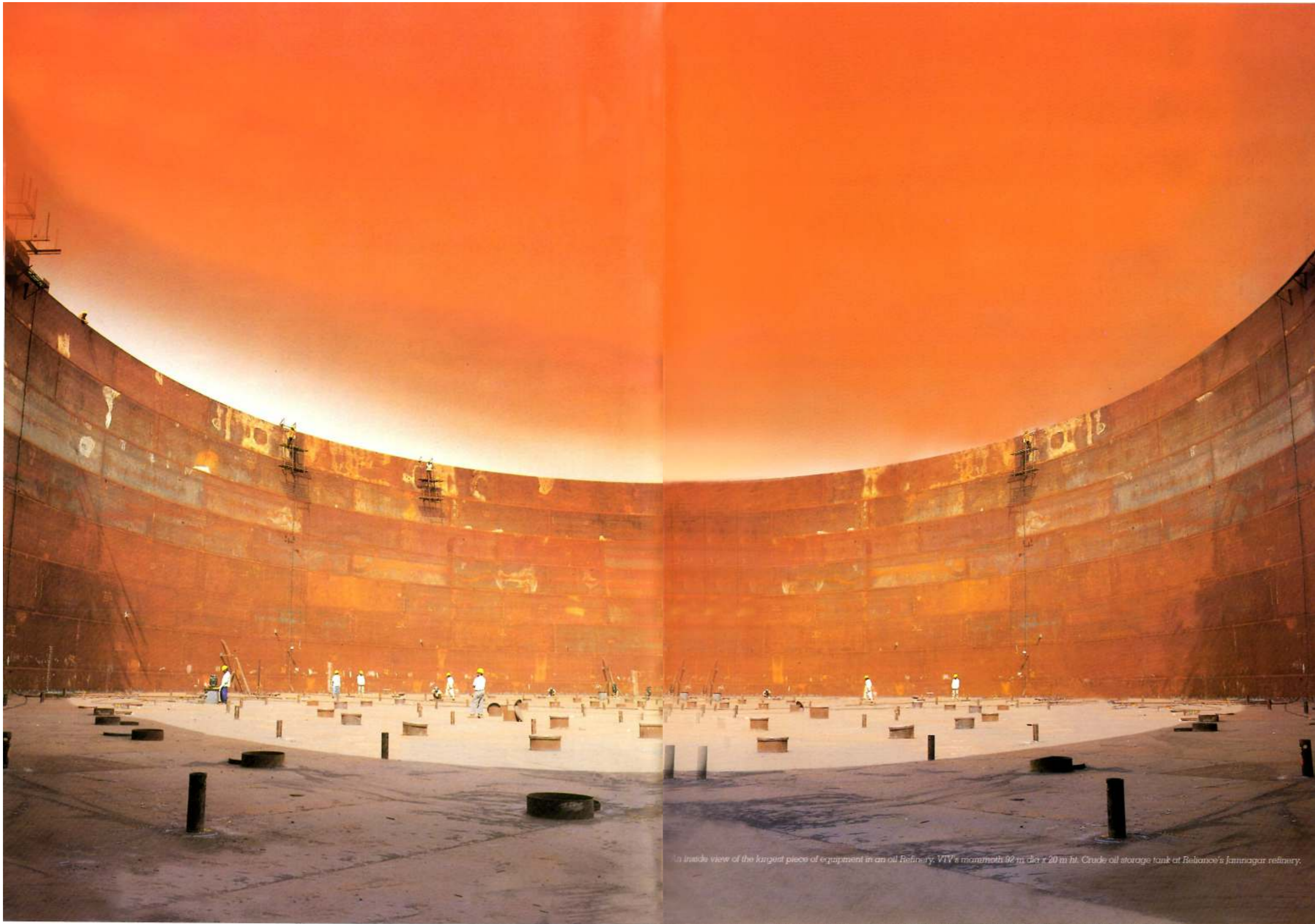
Drums & Barrels

VTV is one of the oldest and largest private sector companies involved in the drums and barrels business in India. VTV has an installed capacity for the manufacture of 5 million drums and barrels per annum for the storage of bitumen, lube oil, paints and other related products. VTV's IS approved

manufacturing plants are located in various parts of the country catering to the refinery, petrochemical and allied industries.

VTV has an inhouse capacity for fabricating more than 15000 drums/day and is geared to meet the growing domestic requirement for bitumen storage drums.





An inside view of the largest piece of equipment in an oil Refinery, VTV's mammoth 92 m dia x 20 m ht. Crude oil storage tank at Reliance's Jamnagar refinery.



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