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A PROPOSAL FOR AN IMPROVED PLANT ACCEPTANCE TESTRUN SCHEDULE TO MEET CONTRACTUAL GUARANTEES

by

UNIDO Secretariat

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PLANT PERFORMANCE GUARANTEE

Introduction

The plant performance guarantees offered by engineering contractors and in many cases their licensors vary a great deal and very often become a subject of dispute between supplier and customer.

To avoid the latter, this paper will outline the guarantees offered normally by plant contractors for chemical and fertiliser plants and highlight those items that would improve the situation from the customer's point of view giving additional incentives to the contractor for optimising his performance in construction.

Customary guarantees by contractors

Guarantees normally take effect on the date of signing the contract or first down payment. Thereafter the contractor starts his work on engineering design and purchasing of first long delivery, then remainder of equipment. The project schedule is in the hands of the contractor for the majority of "Turkey" contracts.

Mechanical acceptance test

Prior to plant completion in the field but before start-up the contractor performs a mechanical acceptance test. This performance test is run to see that all equipment has been properly rigged and is in good mechanical operating condition.

In practice this means that mechanical equipment is turned over and kept running without process material in the plant for 24-48 hours.

Electrical interlocks switch gear and ampere meters for motors are checked and lubrication of moving parts is completed. Simultaneously the plant equipment handling fluids is water batched with the pumps running. Piping is checked for leaks and pressure testing is performed for pressure vessels.

This performance tests give the opportunity to check the equipment supplied by the fabricators not only by the customer but also by the contractor. A certification of acceptance is generally requested from the customer.

Should any equipment fail, the contractor is obliged to either repair the machinery on the spot or replace it.

There is another important aspect of this performance test. The mechanical acceptance performance test is normally run by the contractors start up crew, or at least under their very close supervision. The customers operating crew stands by as observers-helpers under training. It is important that the maintenance department of the customer also participates during assembly and alignment of rotary equipment and the mechanical acceptance tests. The contractor who has to supply the mechanical catalogues and specifications on the basis of which the equipment was purchased, should be used by the maintenance group when checking out each equipment. The contractor should also provide the inspection reports for major equipment at the fabricators shops to see if any

damage has occurred during shipment or construction - storage of equipment that may have been overlooked in handling the machinery prior to installation.

Performance test guarantees

Most contractors for chemical plants will guarantee a 72 hour test run for the plant performed under their supervision to demonstrate the plants performance in accordance with the following guarantees.

a) Capacity: The guarantee of capacity of the plant is defined usually on the basis of 24 hour daily rate or designed rate. This is often called the nameplate capacity of the plant.

If the plant is to produce various formulations, the contractor normally agrees with the customer on a formulation(s) which is chosen for the performance run.

The nameplate capacity of the plant design usually applies to 330 days operation per annum, and in some contracts the annual production are mentioned as an alternative capacity to be reached over 12 month operation.

b) Efficiency or yield: The contractor normally guarantees the plant efficiency or yield, which often depends on more than one factor. In a nitric acid plant or phosphoric acid plant, the per cent conversion of the feedstock to the product is guaranteed as a fixed per cent or within a range of operating capacity.

Normally the yield is tied to the quality of the feedstock which is usually the customer's responsibility. The contractor will normally notify the customer when he considers the plant ready for a performance run. By contract this is often defined as no later than 30 days after the plant start up, depending on the complexity of the plant. The contractor may request the customer for a delayed performance run to prove the plant's ability to meet the efficiency or the guaranteed yield because the skill of the operators provided by the customer is insufficient to provide the close control required for the operation.

c) Consumption of raw materials and catalyst:

The contractors guarantees include the consumption of raw materials which normally determine the yield in terms of product. Catalyst consumption is dependent of yield and operating conditions and can be very costly one, specially where noble metals are used. These guarantees can only be ascertained after several months of operation and have to be excluded from the 72 hour performance test run.

d) Product quality guarantee:

Guarantees for product quality are normal for any manufacturing plant. The customer usually defines the product quality to be met, prior to ordering the plant. The quality has to meet the commercially acceptable grade for the customers market. Very often the control analysis

to be adopted by the customer's control testing laboratory as well as required laboratory equipment are included in the contract as standard procedure. In the case of the prilled urea for instance the biuret content has to be guaranteed and in other cases the P_2O_5 citrate solubility of the NPK product is explicitly tied down for the product quality.

e) Guarantee for utility consumption: It is customary by contractors to guarantee the utility consumption for a chemical plant. In recent years with the increase cost of energy the guarantees have been tighted as a result from pressure exerted by customers. In some cases high temperature processes are net exporters of energy which can be utilized in other processes by the customer and their dependence on the availability is of prime importance.

f) Environmental aspects and connected guarantees

More recently in the last decade attention is being paid to discharge of atmospheric and aqueous effluents from chemical process plants. To prevent their harmful impact on the environment, constructors have provided abatement equipment in their proposal. Nevertheless in countries where no regulatory statutes are in force, constructors have tried to cut corners in the process of competitive bidding and customers have overlooked the environmental damage that a chemical plant can produce. It is therefore recommended that guarantees be requested for and limitations be set for both gaseous and aqueous effluents that could reach public receiving water or be damaging to vegetation and human beings in the atmosphere surrounding the plant.

The guarantee clauses listed from a) to f), all are linked to penalty clauses in the same way as the completion day for a plant agreed upon when signing a contract between supplier and customer.

In case of equipment supplied, the contractor normally passes on the guarantees of the fabricator or supplier which over the years have been a standard one year guarantee after start up of the plant or an 18 month guarantee after shipment of the equipment from the fabricators' shops. Special cases do exist for major equipment such as compressors but these are negotiated by the contractor on the basis of his erection schedule.

The guarantees outlined do not protect sufficiently the customer in developing countries located often isolated areas far from the suppliers and fabricators' base. For this reason the secretariat has prepared a guide for developing countries which, if followed, could prevent or forestall problems and disputes between contractor and customer.

These recommendations have been used by a major contractor and found that their service charge was minimal, yet providing the safeguard to the satisfaction of the customer.

The proposed schedule for plant guarantee acceptance would consist of a) programme covering a period of 12 months from the date of plant start up for the contractor to demonstrate the plant performance and meet the contractual guarantees. This 12 months would by

virtue also coincide with coverage of guarantees provided by equipment fabricators and suppliers.

b) A test programme after start up in which not only daily plant capacity but annual capacity of 330 days or 8,000 hours of operation of the plant can be achieved meeting other guarantees laid out in the contract, on a quarter of a year's operation depending on the type of process or plant.

The penalties suggested for failure of satisfactory performance to meet disign capacity production rates would cover liquidated damages incurred by the customer.

Proposed Test Programme

Most of the large chemical fertiliser plants are designed to operate 24 hours/day and covered by over three shifts by supervisory operating personnel. Depending on the type of process used, the capacity of operation can be reduced. However, in chemical plants using turbine compressors the turn down or reduced capacity operation cannot be maintained below 60 or in some cases 65% of the rated capacity.

The step by step performance test proposed illustrates a 1,000 tons per day ammonia plant (operating with a turbine compressor) which under normal conditions takes three days to reach full capacity in operation.

Test Run 1 - 3 months after plant start up.

Duration of the test run: 10 days allowing 3 days start up operation

Production: 6,500 tons

Test Run 2 - 6 months after plant start up

Duration of the test run: 10 days allowing 3 days start up operation.

Production: 7,500 tons

Test Run 1 - 12 months after plant start up

Duration of the test run: 13 days allowing 3 days for start up operation

Production: 10,000 tons

In case the test runs cannot produce the guaranteed tonnage, the following consequences for liquidated damages shall apply. The formulae denote "a" as the actual tons produced to acceptable quality specified in the contract.

Test Run 1 - 6,500 tons x $\frac{65 - a}{65}$ x 100 US Dollars*

Test Run 2 - 7,500 tons x $\frac{75 - a}{75}$ x 100 US Dollars

Test Run 3 -10,000 tons x $\frac{100 - a}{100}$ x 100 US Dollars

* The 100 US Dollars was assumed as being the produced ex-works cost of ammonia per ton without profit.

Should the test fail, the contractor will pay the liquidated damages and correct the plant within three months to be ready for the next test run. If the contractor comes within 10 per cent of the production target guaranteed, he is permitted to repeat the first test run within two weeks. If within two weeks (the second run) is successful, the penalty will be voided. Such a clause will not be applicable for the subsequent No.2 and No.3 test runs. (If the contractor is successful and can demonstrate both test run 1 and 2 capacities at the same time, he can forego the scheduled test run No.2 but not test run No.3.)

In the period between the test runs, the plant is expected to run at an average production rate achieved during the last test run performed. This means in practice that the plant will have to be shut down. However, if the plant has to be idle or does not produce at an average rate of the previous test run performed, the contractor will be penalised as per the formula for the applicable test run as liquidated damages for the fully scheduled production of this period on the daily basis.

Should one of the tests or more fail, however the production figures of the previous period prove that the plant can reach a certain capacity, i.e. the actual production achieved is higher than the production reached in the test, then the basis for calculating liquidated damages will be actual production figures.

During the proposed test runs, the contractor has the choice of providing his own start up crew to operate the plant or maintain a supervisory staff required to control the operation with the customer's operation. The customer will, however, be responsible to provide the personnel required as well as services of

a) laboratory crew to provide analytical control data and product quality tests;

b) utilities required by the plant;

c) maintenance crew coverage for all shifts.

Conclusion

The extended test run procedure is aimed to provide the following advantages for both contractor and customer.

a) A thorough testing of the plant during four seasons and running is of all equipment under controlled conditions and supervision;

b) Improved training for the customers operating and management personnel who are new to the operation,

c) A chance to meet guarantees for raw material, utility and catalyst consumption under supervised control of the contractor;

d) Verification by the contractor that all the equipment purchased from suppliers meet their 12 month guarantee or warranty provided with the supply.

The price to be paid for this extended period shall be covered in the purchase price of the plant. In some cases it can be covered by a separate management contract proposed by the contractor. This proposal should be of interest to developing countries and in particular those who introduce new technology to their countries for the first time.

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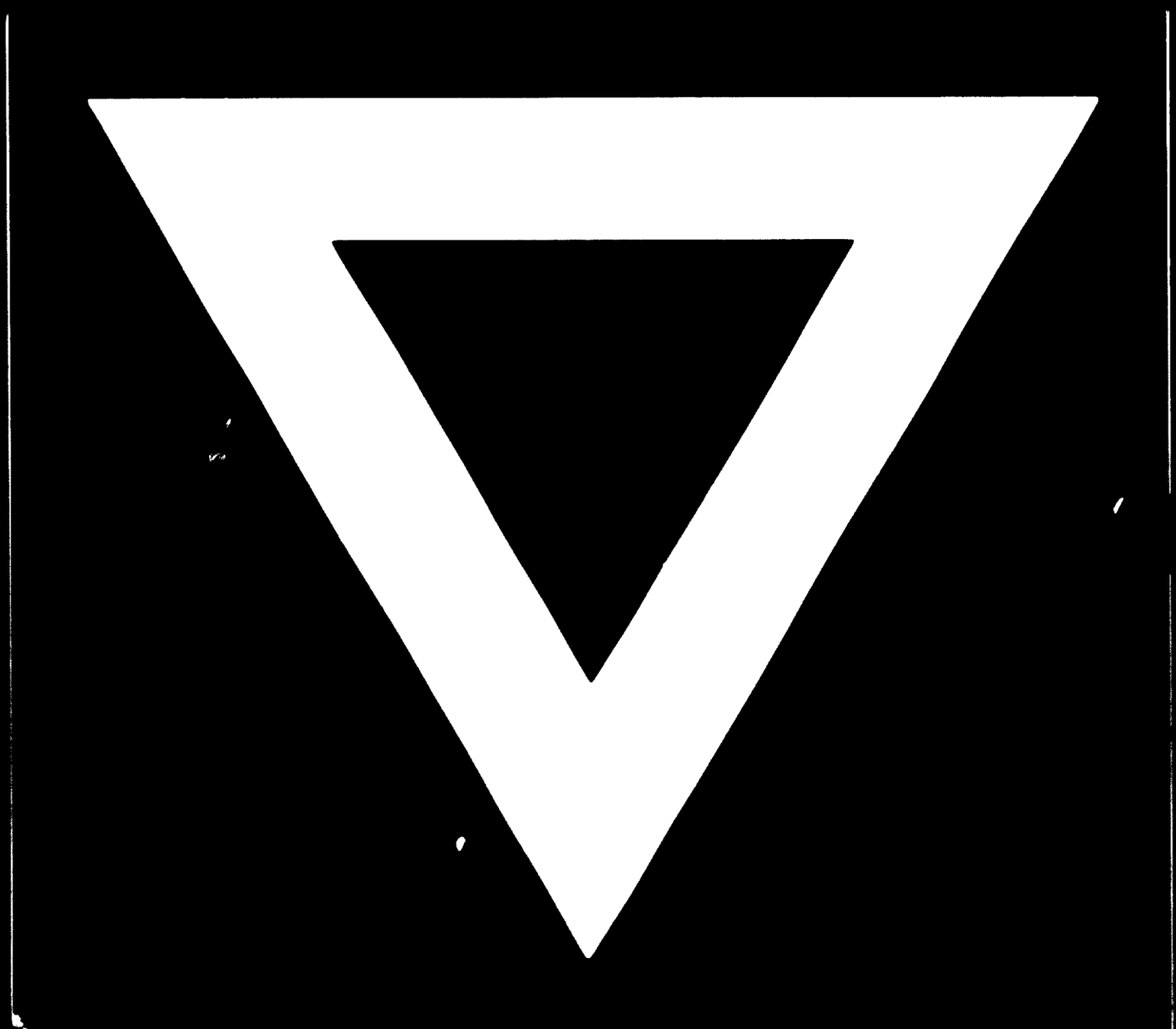

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