Pakistan’s 10th International Convention on Quality Improvement
November 27-28, 2006 - Lahore, Pakistan

STANDARDIZATION IN STATE ENTERPRISE FOR SUSTAINABLE GROWTH IN MANUFACTURING SECTOR

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ABSTRACT
The importance of manufacturing standards in quality assurance system cannot be over emphasized. The standards help to establish a benchmark for marketable products in a highly competitive manufacturing sector. The requirements of modern technology are simple and clear for reduced product life cycle. The changing customer expectations, globalization and financial openness create cutting edge for countries and systems that believe in quality consciousness and standardization. The sector specific standards help to acquire technologies and R&D that creates take off points for growing industries.

The introduction of standards in manufacturing sector will bring standardization in product(s) and improve quality acceptance criteria improving the credibility of exports.

Keywords: Competitiveness, standardization, globalization, sustainable growth, quality acceptance criteria.

INTRODUCTION
Standards in any industry or country govern fundamental acceptance level of the products or services. A standard is defined as the level of quality or excellence that is accepted as the norm by which actual attainments are judged. American Society of Testing and Materials (ASTM) provides a platform for consumers, suppliers, Government and academia to perform acceptance testing to assess whether American products and services meet acceptable industry standards. The ASTM standard is defined as set of rules that has been established with the consensus principle of society and that meets the approval requirements of ASTM procedures and regulation. The cycle of working of a discrete product and description of the scope of standards, Khan (2006) for engineering design and manufacturing is shown in fig 1.
A complete cycle of the working of discrete product

The working cycle explains the requirements of input energy such as thermal, hydraulic or electrochemical reaction to drive the machines to give output energy or work form. These actions which have an objective function result into waste such as gases or solids. The structure, mechanisms and machines contributing to a discrete product have static or dynamic components which are assembled together to give us the required structure, mechanism and machines. The description of standards signifies the need for acceptance criteria for product as a whole, during the process, assembly, manufacturing and Quality Assurance.

Other developing countries have applied standards where required. This accentuates the fact that application of required standards through systematic evaluation and verification benefits all producers.

The Importance of manufacturing standards in quality assurance system cannot be over emphasized. Standards help to establish a benchmark for marketable products in a highly competitive manufacturing sector. The introduction of
DEVELOPMENT OF MANUFACTURING INDUSTRY

Standards in any manufacturing sector brings standardization in product(s) and improves quality acceptance criteria, enhancing credibility of exports. The problem identified for the manufacturing sector in any country is lack of sector specific standards which are necessary to provide a basis for growth.

BENEFITS OF THE STANDARDIZATION

DIN (German Institute for Standards) in a case study DIN (2000) has analyzed the benefits of standardization on businesses, standard bodies, economy and state. The study indicates the general ignorance of German industry about standards and consequent advantages in cost, competitiveness, product safety and R&D cost savings. The study further highlighted the benefit of technology changes, innovativeness, foreign trade, exports and trade barriers on the economy.

The analysis from the research is presented here:

Improvement in the quality of products

There are positive effects of company wide standards for competitiveness as compared to industry wise standards. A greater competition for quality and reliability exists as standards avoid dependence on a particular supplier.

Quality of services, health, safety and environment

International standards help to achieve greater competitiveness and technology transfer from advanced nations through transparent technical specifications and removal of old standards.

Efficiency Resources

Based on the concept that technical rules are turned into specified standards, the companies already in process of adopting standard avoid cost of conforming a standard introduced at later stage. It is experienced that standards are not a hurdle to innovation / R&D and Company wide standards are profitable for firms having common goal than following industry wide standards.

Trade enhancement

Harmonization of European & international standards results in lower trading costs and large number of standards in a particular sector results in export surplus. Furthermore identical international standards result in simplification of contracts and lowering of trade barrier.

STANDARDS AND INDUSTRIAL COMPETITIVENESS

Existing research is based on the adoption of sector specific standards by technologically advanced nations and innovative countries. These efforts by technologically advanced countries to maintain their competitive edge through standardization and diversification of products is advocated by quality Gurus like Deming, Juran and Ishikawa, who contend that development of high quality products is possible only through R&D. In other words improved materials and process technologies innovation and highly skilled manpower can only be developed through knowledge of sector specific standards and efforts undertaken to attain these standards.

Research is being conducted on an increasing number of processes, features etc of conventional and non-conventional production. Even negative processes of production which are thought to be irreversible can benefit from the application of standards. Hoar (1976) has quantified the cost of corrosion in the absence of any acceptable standard for corrosion control. Historically, for plants and product life cycles allowances for corrosion losses is taken in to account, however this study yields optimistic results with regards to the estimates of saved cost on account of corrosion control. He estimated that a savings of 310
Million pounds compare to their investment of 1365 Million pounds for industries like Engineering, oil, power and transport. His findings are valid for all industries which use metallic and nonmetallic coatings will incur similar corrosion costs.

STANDARDS AND THEIR NEED FOR INDUSTRY

This research investigated the availability of manufacturing standards in organizations, how they can be applied in setting quality standards and reducing costs. This Study targets Public and private enterprise involved in manufacturing of various products and dependence on sound rationale for quality assurance program in products and process design. The interface of technology and availability of relevant standards demonstrate potential strength of the manufacturing sector to be competitive in post WTO environment. It is envisaged that these sector specific standards will create good competitive grounds for our Oil & Gas, IT, manufacturing and textile sector. Standardization will improve productivity in agricultural sector which is seriously hampered by absence of quality standards for machinery, yield, irrigation and fertilizers.

This research involved analyzing production processes and subjecting these processes to detailed analysis and evaluation for availability of standards. This compared Special welding processes based on Gas Tungsten Arc welding (GTAW) and Plasma Welding for American welding society standards and American National Standard Institute (ANSI). A case study from a local industry is presented here to have a comparative model for the subsequent research.

CASE STUDY

A study for welding through GTAW and Plasma techniques in a Boiler Manufacturing unit for low alloy steel was carried out. The study initially used TIG technique for welding and then switched over to plasma technique for welding of the boiler parts to understand the phenomenon and possible effects of mix mode welding. ASTM A 577 describes the method for straight beam ultrasonic examination for steel plates. The standard was applied for the acceptance of steel plates. After rolling of steel sheets a standard for straightness by American national standard institute standard (ANSI no H35.2 having allowable tolerance deviation of 0.3 mm for length more than 12.5 mm was followed.

Table 1: The welding Parameters for Plasma and TIG

<table>
<thead>
<tr>
<th>Parameters</th>
<th>GTAW</th>
<th>PLASMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weld passes</td>
<td>4</td>
<td>1 or 2</td>
</tr>
<tr>
<td>Current Range</td>
<td>180 Amp</td>
<td>155 Amp</td>
</tr>
<tr>
<td>Wire Speed</td>
<td>17 cm/min</td>
<td>65 cm/min</td>
</tr>
<tr>
<td>Carriage Speed</td>
<td>20 cm/min</td>
<td>25 cm/min</td>
</tr>
<tr>
<td>Operating Temp</td>
<td>2800–3200 C</td>
<td>3000–3500 C</td>
</tr>
<tr>
<td>Deformation</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>HAZ</td>
<td>Large</td>
<td>Less</td>
</tr>
</tbody>
</table>

TIG (electric arc welding) SAF Training Manual (2002) uses a refractory electrode with a gaseous atmosphere. The inert gas (Argon / Helium) isolates the melting metal, hot zones and Tungsten electrode from the air. The heat given by the arc causes the part and the filler metal to melt and a bead is formed. The weld has good quality and compactness.

The Plasma works on the concept that in the natural state, a gas is a neutral electric insulator. The atoms of gas are in rapid motion and this is increased when the movement of gas is increased. The number of electrons leaving the atoms also increase the atoms breaking loose are said to be ionized. With accelerated movement, this causes increase in temperature to go up to several thousand degrees. This ionized gaseous body is conductor of electricity and called Plasma. When Plasma is used in welding the arc reaches 25000 degrees K through concentration of energy transmitted to the part. This is due to the mechanical arrangement and constriction of the electric arc in gaseous
atmosphere.

The requirement of heat treatment is dealt through Table A, 1.2 ASTM A 480/A Requirements for heat treatment which signified heat treatment temperature of 1040 degrees centigrade and quenching in water or through other means. The data for qualification of Boiler sheets is presented here which will demonstrate a higher rate of non conformance in product acceptance and subsequent repairs involving high cost of quality.

![Quality Acceptance-Parts](image)

The values for allowable deviation from specified diameter is important in line with Table A 2.10 of ASTM A 480 which stipulates Permissible allowance of 6 mm over a diameter from 600-1200 mm. A data was taken to measure allowable deviation from specified diameter in pressure vessels welded through GTAW and Plasma techniques. Although variations are not pronounced but significant difference is observed in the values for allowable deviation. The values are recorded in mm.

**ANALYSIS**

The case study analyzed the causes of non-conformances in the developmental stages. The rework due to defective welding was present in two out of eight sheets in case of GTAW welding and four out of eight sheets in case of plasma welding. From the study conducted, it is concluded that changes in welding process from GTAW to plasma warranted a change in process parameters like current, speed and use of electrodes. These parameters were adopted; however, instead of a straight edge preparation a V notch preparation was followed. This resulted in multiple passes required for the GTAW being applied for Plasma welds. Increased number of passes resulted in deformation in plates and radiographic defects leading to excessive repairs. A study is currently undertaken to highlight the effect of special heat treatment cycle required for Plasma welding to minimize distortion and qualify all required mechanical properties as per standard.

Quantitative analysis of single and multiple repairs has been identified through cost estimation. The data is shown in the table and highlighted as cost of Quality in case of rework / Process finalization.
Based on the case study as a benchmark for our research, application of manufacturing standards was analyzed in public sector organizations such as Railways, ACES Engineering, HMC and ACP. Some of the results/salient of the study analysis are presented here. The results of variables are shown in consolidated form at the end.

**Training**

Training dealt awareness about standards in Organizations, level of training imparted, special techniques and documentation. Training was graded higher in case of organization having transfer of technology (TOT) and more importantly as process requirement. It was low in other public sector organizations having no or
little TOT. Pakistan Railways provide good training to raw welders in special technologies such as CO₂ welding. However they are unable to retain qualified welders due to less pay and incentives, however had auto dated standards and documents?

Availability of Standards

Issues such as availability of inspection standards, special techniques, acceptance criteria’s, process documentation, technology and drawings were analyzed Public sector organizations did fairly well on the availability of relevant standards and pertinent documents.

Application of Standards

Application of welding parameters, use of inspection instruments, environmental conditions and acceptance of welding materials prior to use were focus of research. Significantly, organization with some form of TOT have inbuilt mechanism to follow standards. Sampled firms with little or no TOT demonstrate less application of standards.

Acceptance/Rejection

Respondents were inquired about recording of data, minimizing welding problems, customer feedback and steps taken to improve quality after analysis of reject products. The quality of products was gauged fairly satisfactory in case of sampled organizations. Importantly, firms having adopted sector specific standards in tangible form demonstrated improved results as compared to other organizations.

Calibration

Calibration and verification of instruments used in welding process. The comparison of performance was based on the sampled firms having some form of calibration activity for special instruments. It is concluded that a wide gap in quality of product exists between organizations having well placed calibration system as compared to those having none system. The quality of the product is affected due to non-calibrated instruments that result in inferior products.

Feedback

Data for non-conformances, complaints from user and monitoring by top management were analyzed. Feedback on welding merits a sound approach to minimize quality related failures and improved products. Feedback was very good in one sampled organization and satisfactory in all others. It can be inferred that importance of feedback is lacking in most cases. Consequently steps taken to minimize such bottlenecks through frequent analysis by management will improve quality of the product.

Figure 9  Application of Standards against selected Variables
REFERENCES


12. SAF Manuals on training for Plasma and TIG welding (2002), Issue N-0 No