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SELECTING THE RIGHT WELDING & CUTTING EQUIPMENT

INTRODUCTION

It is very important to select the right welding process and equipment for a fabrication job. Selection of either inappropriate welding process or equipment leads to quality problems and at times to rework / delays which reduce productivity. This assumes greater importance because of multiple choices available due to technological advancements. The selected welding process and equipment influence the overall welding cost of a fabricated structure. This mailer provides guidelines to select the right welding and cutting equipment for a given application.

IMPORTANT CRITERIA FOR SELECTION OF WELDING AND CUTTING EQUIPMENTS

As mentioned above, multiple choices of technology are available for welding a given structure or job. In general, following important criteria should be considered while selecting equipment for “best fit solution”.

- Study of applications
- Arc welding process selection
- Equipment type/technology type available
- Environment and field or site conditions
- Duty cycle at which equipment is proposed to be used

Product Update

CHOPREC 401

- Faster response time through 40 Khz switching frequency circuits resulting superior welding
- Improvement in the protection circuits for superior fool proofing against failures
- Improving reliability of key components by a factor of 4 over previous generation which has been done in consultation with component manufactures

RANGER 400/ 600

- Enclosure/ protection desired
- Class of insulation required
- Input supply conditions and electrical protections required thereof
- Maintenance of equipment/ availability of service
- Availability of equipment with special features

STUDY OF APPLICATIONS

Before selecting welding equipment, particularly for projects where large number of equipment will be required, it is always better to study the applications to understand following:

- Types of welding processes to be used at a particular site
- Are the welding processes and parameters accurately defined in the drawings and WPS/PQR established?
- Productivity level, project completion time schedules etc.
- Use of conventional or new technology -energy efficient equipment
- Indoor or outdoor use
- Whether equipment are to be used for a specific project and shall be disposed off subsequently once the project is over
- Criticality of application and any specific requirement / approval from customer's customer or third party/inspection agency required
- Specific delivery schedules, demonstration of equipment etc required, as applicable.
- Costing budget.

Analysis of above will help select optimum solution of equipment for the given application

SELECTION OF RIGHT ARC WELDING PROCESS

Different metals can be joined by one or more welding processes. Also different welding processes require different skill levels from welder. Therefore, as a first step, select the process for a given metal to be joined from the table given below:

	Welding Process						Cutting Process		
Metal Type	Stick	MIG	FCAW	SAW	AC-TIG	DC-TIG	CAC -A-AC	CAC -A-DC	Plasma
Steel	√	√	√	√		√		√	√
Stainless	√	√	√	√		√		√	√

- Sturdy, compact and 100% dependable, portable power source
- A wirefeeder half the normal weight of the conventional one,, minimizes welder fatigue
- Added operator safety because of low voltage supply to wirefeeder from the source

MAESTRO SERIES

- Choice of Boom mounted or Tractor mounted models with Diode / Thyristorised Power Source
- Bcom mounted head comes with a choice of manual, semi-motorised and fully motorised cross slides
- Programmed sequential operations of Power Source, Wire Feed and Carriage through built-in solid state circuitry

Steel									
Aluminium		√			√			√	√
Cast Iron	√							√	√
Copper, Brass		√				√	√		√
Titanium						√			√
Magnesium Alloys					√				√
Skill Level	Moderate	Low	Low	Moderate	High	High	Moderate	Moderate	High

(CAC-A-AC=Carbon Arc Cutting with AC power, CAC-A- DC= Carbon Arc Cutting with DC power)

As mentioned, more than one welding process can be used for a given requirement. The advantages and the merits of various processes are given below which will help select right process for the given application.

A		**SMAW/MMAW / STICK WELDING**	• Most suitable for outside/open door use • One of jobs or relatively less volume jobs • Better accessibility for intricate joints • Ideal for dirty/rusty surfaces
B		**GMAW/MIG/MAG CONTINUOUS WELDING**	• Suitable for high welding productivity • Most suitable for relatively thinner sheets • Very neat and clean welding without slag removable • Easy to learn for welders
C		**FLUX CORED (FCAW)MIG/MAG**	• Suitable for deep penetration for welding thick sections with less nos. of runs • Provides higher welding deposition rates • Gives excellent weld bead shape
D		**SUBMERGED ARC WELDING (SAW)**	• Most suitable where excellent mechanical properties are required • Suitable for heavy duty longitudinal structures like girders • High deposition rates gives higher welding productivity • Gives excellent weld bead shape
E		**TIG WELDING (GTAW)**	• Used where highest quality welding required • Gives precise welding with very

			• good welding finish • Most suitable for thinnest sheets where better heat input controls are required and very minimal distortion allowed
F		**PLASMA ARC CUTTING**	• Used with almost all electrical conducting metals • Distortion free, dross free, burr free, narrow kerf with clean cuts, compared to carbon arc cutting
G		**AIR CARBON ARC CUTTING (CAC) AC & DC**	• Cutting operation is performed by the arc generated between Carbon or graphite electrode and the base metal with adequate air flow to remove the metal • Used to remove metal from defective weld area

SELECTING WELDING EQUIPMENT OF RIGHT TECHNOLOGY

Inverter or Chopper type power sources have a power factor about 0.92 and efficiency more than 85%. The energy cost for using these types of welding power sources will be much lower than the transformers and diode type rectifiers as illustrated in the table given below. Apart from the lower energy bill, welding performance also improves with the use of Inverters or Chopper based power sources, since spatter level is much lesser with these power sources.

Inverter based/Chopper based 400A Rectifier, Electrode -5.0 mm, and Weld current – 200A

Parameter	Diode based	Thyristor based	Inverter based	Chopper based
Weld current	200	200	200	200
Input Current	27.0	21.5	11.4	11.5
Input KVA	18.8	15.5	8.40	8..6
Input KW	10.0	9.0	7.0	7.2
Power factor	0.53	0.58	0.84	0.84
Efficiency %	60	70	85	84

ENVIRONMENT AND SITE CONDITIONS

Welding equipments are designed for operation at 40 Degree Celsius ambient temperature and at 1000mtr altitude as per international standards. For applications at higher temperature and higher altitudes, these machines are to be suitably derated in

consultation with equipment manufacturers, since ventilation gets affected at higher temperatures as well as at higher altitudes.
If ventilating air is very salty or corrosive or contaminated with acidic fumes, dust/dirt etc, then windings should be protected with additional layer of resin impregnation and printed circuit boards should be epoxy coated to protect them against corrosion etc. The terminal connectors should be suitably treated and sealed so that they do not get short circuited due to dust/dirt and do not get open circuited due to corrosion or oxide formation at contact pins.
Site conditions should be studied and recommendations should be made to ensure satisfactory performance of welding equipment.

SELECTION OF EQUIPMENT FOR DIFFERENT DUTY CYCLES AND LOAD CONDITIONS

Following guidelines can be observed for the selection of equipment based on their expected workload.

Duty Symbol	Workload/Usage / Duty	Likely Duty cycle	Welding current Range Recommended
L	Light Duty Single shift	20% to 35 %	Up to 225 Amps
M	Medium Duty Single or Two Shift	>35% to 60%	225 Amps to 300 Amps
H	Heavy Duty Two or Three shift	> 60% to 100%	More than 300 Amps

DEGREE OF PROTECTION FOR ENCLOSURE OF WELDING MACHINE

The degree of protections offered by the enclosure is indicated by letters IP21, IP22, IP23, IP44 etc. The letter IP means International Protection class; the first digit of suffix indicates protection against the ingress of foreign body (2 indicates the body size 12 mm or more, 4 indicates the body size between 1mm and 12 mm dia); second digit indicates protection against ingress of splashing rain water (1 indicates splashing water up to 15 degrees from vertical plane and 3 indicates up to 60 degrees from vertical plane and 4 indicates all around the machines). IP23 and IP44 are recommended for machines for outdoor use where as IP21 & IP23 are recommended for machines for internal or shop floor use.

CLASS OF INSULATION OF WELDING MACHINES

Insulation class F withstands temperature up to 155 degree

Celsius and insulation class H withstands temperature up to 180 degree Celsius. Insulation class H should be recommended for machine for higher ambient temperatures and where machine is likely to be used at higher welding currents. Normally welding machine with H insulation class is more reliable in difficult or worst ambient conditions.

INPUT SUPPLY CONDITIONS AND ELECTRICAL PROTECTION

Welding equipments are used within the shop floor as well as at project sites. Welding equipment need to be protected against extreme over voltage, under voltage, and voltage/current spikes. User must therefore, make sure that such protections are provided on the machines to avoid frequent breakdowns of machines due to erratic input supply conditions. Apart from under and over voltage protections, machine should be provided with single phase, over load and over heating protections to prevent overloads and avoid breakdown and loss of productive time.

MAINTENANCE/ AVAILABILITY OF AFTER SALES SERVICE

Often equipment is sent to different sites on specific requirements. Users must check availability of service from manufacturer at these locations to ensure minimum downtime.

AVAILABILITY OF EQUIPMENT WITH SPECIAL FEATURES

Welding equipments with following additional features are available and can be selected where essential

- Power sources with built in Energy Saving Devices (ESD)
- Power source with Arc On time measurement/indication (ARCON)
- Voltage Reducing Devices (VRD), where output voltage is reduced to a safe limit when power source is not in use
- Ventilation or air suction to the power source, only when required
- Use of multiple wires simultaneously to improve the productivity
- Welding Payloads for simultaneous use by 2 /4/6/8 or more welders

CONCLUSION

The user will be benefited by going through the above criteria for selecting right equipment to improve welding productivity.

Ador Welding Ltd. offers a wide range of welding and cutting equipment for these processes. Please click on the name of equipment to view detailed specifications:

Welding Process	Transformer AC power sources	Diode based DC power sources	Thyristor based DC power sources	Inverter based DC power sources	Chopper based DC power sources
SMAW	E Welmac 150 E Welmac 190 DM 250 DR 300 DH 400 DS 500 RED 403/503 TPA 303/403	GL 401 GL 601 Silent Challenger 301 Silent Challenger 401 Silent Challenger 501	Thyroluxe 401 Thyroluxe 500 Thyroluxe 600	Champ 150 Champ 163 Champ 253 Champ 400 Champ 600	Choprec 401 Silent Challenger 2x300
GMAW / FCAW MULTI		Maximig 251/400 Automig 250/400	Ranger 400/403 Ranger 503/600 Ranger Multi 600	Champ Multi 400 Champ Multi 400 (SSPW)	Silent Challenger Multi 2x301
GTAW	RED 403 RED 503 HF 2000AD HF 3000AD	GL 401 GL 501 HF 2000/AD HF 3000/AD	Thyroluxe 401 Thyroluxe 500 Thyroluxe 600 HF 3000	Champ Tig 163/303, 300AD 303AD	
SAW		Maestro 600/800/ 1000/1200	Maestro 600/800/ 1000/1200(T)	Maestro 1000 (i)	
AIR PLASMA CUTNG		Plasma cut 25		Champ cut 8 Champ cut 25	

Please contact cmo@adorians.com for advice on selecting welding process and equipment to improve weld quality and productivity while reducing downtime and rework.

Project Engineering Solutions

ADOR Institute of Welding Technology

Welding & Cutting Solutions

Centre for Engineering Excellence

WELDERS TO THE NATION

ADOR WELDING LIMITED

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