

Replacing Transformer based Welding Machine with Inverter (IGBT) based Welding Machine

Aurangabad Mixed MSME Cluster

Cluster Brief:

Aurangabad (Maharashtra) is a prominent MSME Cluster and houses about 1000 Auto parts Manufacturing MSME Units located in major industrial Areas Waluj – MIDC and some in outskirts of the city in industrial area like Chikalthana etc. The Auto Component Units in Aurangabad Cluster are principally known for rubber, metal and plastic components for auto and non- auto Sectors.

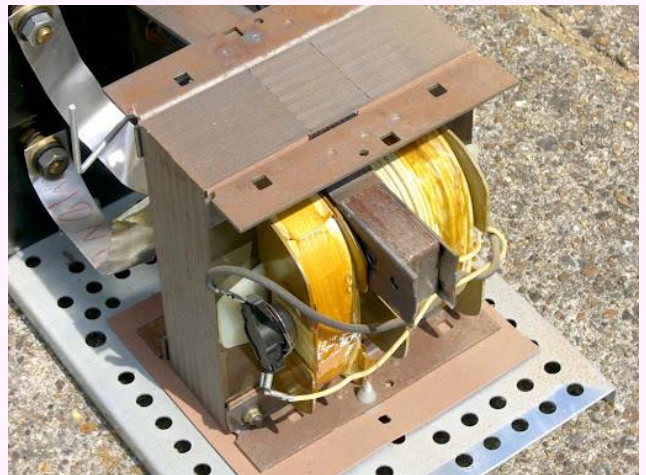
Aurangabad has mainly metal, plastic, rubber component and tyre retread industries which caters to the auto OEM's like Bajaj Auto, Skoda Auto, Audi etc. and Non-auto like Siemens etc.

Deogiri Rubber Cluster Foundation is the local industry association having about 50 members industries from rubber sector. The association has formed one Common Facility Centre (CFC) for rubber mixing, which provides ready pre-mixed rubber as raw material to its member industries. The production capacity of the CFC is around 70 to 100 tons /day.

Pratishan Forging Cluster Foundation is another local industry association managed by forging industries in Aurangabad with around 150 members. This association has also setup a CFC for Shot blasting, drawing, cutting and forging operations.

Present Technology:

Many of the metal fabrication and auto component manufacturing units in Aurangabad employees' transformer based welding machine for various types of welding requirements. The transformer welder permits the welder to choose the output current by moving a winding closer or away from a secondary winding. It can also move a magnetic shunt inside and out of the transformer's core, utilizing a series saturating reactor with an alterable approach in series with the secondary current output, or by just allowing the welder to choose the output voltage by tapping on the secondary winding of the transformer. They come in sizes from 250A to 600A at 415V.



Based on the discussion held with industry owners, it is reported that many of the fabrication units uses 3 - 5 transformer welding machines for their welding operations making it a good potential for replacement for energy savings. Presently, it is observed that a transformer welding machine consumes around 3.0 – 3.5 kVA based on the nature of the welding and type of the component. It is also reported that the machines are very heavy and requires good ventilated space requirement for installation. When it comes to the quality of finished welding where the aesthetics of the component matters, it does not give good results.

Proposed Energy Saving Technology:

An inverter welding machine converts alternate current to a lower usable voltage output. For instance, from 240V AC power supply to 20V DC power output. Inverter-based appliances use a couple of electronic parts to transform power. The traditional transformer-based appliances primarily rely on one large transformer to control the voltage. An inverter operates by increasing the primary power supply frequency from 50Hz up to 20,000 – 100,000Hz.

This is done using the electronic buttons that switch the power on and off fast (up to one-millionth of a second). By using this way to control the power supply before it gets into the transformer, the size of the transformer can be greatly lessened.

With the inverter welding machine, you can adjust the weld bead profile as per the thickness you require. Inverter welders improve the appearance of the weld and at the same time maintain the welding quality. The inverter welder's mechanism is highly efficient and stays chilly even with the elongated operation. Usually, they use minimal filler metal. They efficiently reduce heat input and provide superior productivity.



Justification of technology selection:

Since, large number of auto parts makers in the Aurangabad uses welding machines that too in multiple numbers, this technology could offer a good potential for energy reduction in metal fabrication units.

Not only are inverter welding machines energy-efficient, but also back stress-free and no-cost connection. Inverter welding machines are a perfect replacement for Transformer welding machines when it comes to generating heat and consuming energy.

An inverter welding machine has a power output of up to 93% as compared to Transformer welding machines. The production level of Transformer welders is 60%. The inverter significantly lessens the transformer and size of the reactor and the welder's weight. The comparable loss of power (mostly conductor energy consumption and magnetic core loss) is also significantly reduced.

Transformer based welding machines use alternating current (AC) and, therefore, these appliances don't get continuous current and power output.

Inverter welding machines can quickly gather power using any gate current appliance. This is possible because of its insulated gate bipolar transistor technology. The inverter welder's switch also operates fast and uses less energy to do the final operation.

Energy & Monetary Saving:

The detailed energy savings calculations for replacing Transformer based Welding Machine with Inverter based Welding Machine are given in the table below.

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As per the observations, the energy consumption of transformer based welding machine measured to be 2.8 kVA whereas the Specific Energy Consumption is calculated as 0.014 kVAh/kg.

The energy consumption of inverter based welding machine noted to be 1.8 kVA and the Specific Energy Consumption is calculated as 0.009 kVAh/kg.

Replacing Transformer based Welding Machine with Inverter based Welding Machine		
Parameters	Units	Values
Electrical Load of Transformer based Welding Machine	kVA	2.8
Production output	Kgs/ Hr	200
Operating Hours	Hrs/ Day	10
Specific Energy Consumption – Existing	kVAh/Kg	0.014
Electrical Load of Inverter based Welding Machine	kVA	1.8
Production output	Kgs/ Hr	200
Operating Hours	Hrs/ Day	10
Specific Energy Consumption – New	kVAh/Kg	0.009
Specific Energy Savings	kVAh/Kg	0.005
Percentage Savings	%	35.7
Annual Energy Savings (@ 330 Operating days/year)	kVAh	3300
Annual Energy Cost Savings (Tariff Rate @ Rs. 9.60 / kVAh)	In Rs.	31680
Investment for Inverter based Welding Machine	In Rs.	80000
Payback in Years	Years	2.5

Based on the energy savings calculations, the annual electrical savings would approximately be 3300 kVAh annually (@ Rs. 9.6/ kVAh). The total cost savings calculated is Rs. 31680/ year. The estimated technology installation cost is Rs. 0.80 Lakhs per installation; the simple payback period for the same would be nearly 2.5 years.

The benefits can be summarized as:

- 35 % reduction in energy consumption
- Improved quality output
- Payback within 3 years
- Easy to implement/ install
- Good in demand

Replication Potential:

Based on the discussion with associations, unit owners and energy audits, it is estimated that the technology has a replication potential of about 400 Nos. Based on replication potential, the overall project benefits will be as follows:

Parameters	Units	Values
Annual electrical energy saving (1 No.)	kVAh/year	3300
Annual electrical energy saving (400 Nos.)	kVAh/year	1320000

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Parameters	Units	Values
Annual CO ₂ emission saving (1 No.) ¹	tCO ₂ /yr	2.7
Annual CO ₂ emission saving (400 Nos.)	tCO ₂ /yr	1082
Estimated investment in technology (1 No.)	Rs in Lakh	0.8
Estimated investment in technology (400 Nos.)	Rs in Lakh	320
Total Investment	in million USD	0.43
Life time energy saving	GJ	47520
Life time CO ₂ saving	tCO ₂	10820

Availability of the Technology:

The following are the technology providers who can supply the technology in the cluster.

Name of the Company	Address	Contact Details	Brand Name
Bhavintech consultants LLP	Office No. 1407, 14 th Floor, Vaishali, site – 1, Gaziabad - 201010	Mr. Ishan Sharma 91-8826999022	BWELD
Shree Trading Company	Plot No. 79, Morya Classic, Flat No. 3, Poorna Nagar, Behind RTO Office Pradhikaran, Chinchwad, Pune 411019	Tel. : 7722078348 Email: sales@shreetrade.co.in	Panasonic
Weld Tech Corporation	S No 14/1 Jeevan Nagar Near Shreyash Hotel, Tathawade Chowk, Pune - 411033, Maharashtra, India	Tel: 7057908751/ 7057243875	Panasonic

Effect on the process:

This technology will increase the overall quality of the metal products being welded and would reduce the overall energy demand.

Reasons for unpopularity:

This technology has yet not penetrated the cluster because of the following reason:

- Not aware about the energy saving aspects of the technology
- Resistance to invest for the new technology as it is difficult for the small unit owners to do cost benefit analysis

¹ CO₂ Emission: Electricity - 0.82 kg/kVAh