

## **INDUCTION HARDENING – CRANK PINS**

**Product Code(ASICC) : 96825**

**Quality & Standards : As per Customers' requirements**

**Production Capacity : 30,000 nos. per year**

**Month & Year of : March, 2012**

**Preparation**

**Prepared by : MSME DEVELOPMENT INSTITUTE,**  
**(Metallurgy Division)**

**C.G.O. Complex, Block“C”,**  
**Seminary Hills, Nagpur – 6.**

## 1. Introduction:

Induction hardening is generally carried out to make outer surface of steel component hard and to increase wear resistance of material without loosing its original toughness and ductility of the material. It's main application is in manufacturing of automobile components viz. Crank Pin, gears crank shaft, crank pins, axles etc.

## 2. Market Potential:

Heat treatment servicing unit has got a wide scope for development under SSI sector because of higher growth rate of automobile industries in our country. Hence, it can be early set up near by automobile/forging industries.

## 3. Basis & Presumptions:

- i. Total no. of working days - 300 days per year
- ii. Working hour per shift - 8 hrs.
- iii. Capacity utilization - 75%
- iv. Labour charges - As per min. Wages Act prevailing in the state.
- v. Margin money - 25% of the capital investment
- vi. Heat treatment charging rate of job work is taken as per 75/- per piece, calculated on the basis of surface area of the job work and depth of hardening, of the. localized portion of the work piece. Material to be hardened is a job work, hence not taken in to the account of raw material cost.
- vii. Interest rate on fixed & working capital - 12% per annum
- viii. Cost of machine & equipments, raw material etc obtained, may vary from place to place with the time.

## 4. Implementation Schedule:

1. Scheme preparation and approval - 3 months
2. Selection of site - 1 month
3. Sanction of loan - 2 months
4. SSI Provisional registration - 1 day
5. Machinery procurement, erection & commissioning-2 months
6. Power connection - 1 month
7. Trial run - 2 months
9. Commencement of production - 5 months onwards

**5. TECHNICAL ASPECTS:**

**a) Production Details & Process of Manufacture:**

In induction hardening process, the heating of steel component is achieved by electro magnetic induction. A conductor (Coil) carries an alternative current of high frequency is induced into the work piece placed within magnetic field of the coil. As a result, induction-hardening takes place & heat so generated affect the outer surface of steel component due to skin effect. The degree of flow of current on the outer surface of a component depends on frequency, resistivity and permeability of the material. For a given material, the last two factors depend on temperature. The depth to which the current penetrates and raise the temperature is given by the following relation for steel components.

In cold state (at room temp.),  $d_{20} = \frac{1}{\sqrt{f}}$  (i) In hot state (at 800 deg. C),  $d_{800} = \frac{500}{\sqrt{f}}$  20 deg. C ii) Where 'd' is the depth (mm) to which current flows and 'f' is the frequency (Hz) of the current carried by the coil. It shows that the depth of hardening decreases with increase in frequency. In addition to direct heating of the skin by induced current, there is also some heating of the wire due to conduction of heat. Hence, the overall depth of heating is greater than that given by equations (i) & (ii).

Accordingly, the overall depth of penetration of heat ( $d_o$ , in mm) at 800 deg. C is given by the relation.  $d_o = d_{800} + d_c$ , Where  $d_c$ (mm) is the depth of penetration of heat due to conduction and given by relation  $d_c = 0.2 \sqrt{t}$ , where t is heating time (in seconds).

Heating of component is maintained for a few seconds only, depending upon depth of hardening of the material. Then it is immediately quenched by a jet of cold water (in case of plain carbon steel) or by servo quenching oil (in case of alloy steel). Hardening temperature for carbon steel is maintained at 760 deg. C whereas for alloy steel like Cr-Mo Steel it is about 800 deg. C. Due to quenching, a martensitic structure is formed which makes the surface hard & wear resistant.

Process conditions for Induction hardening of Steels.

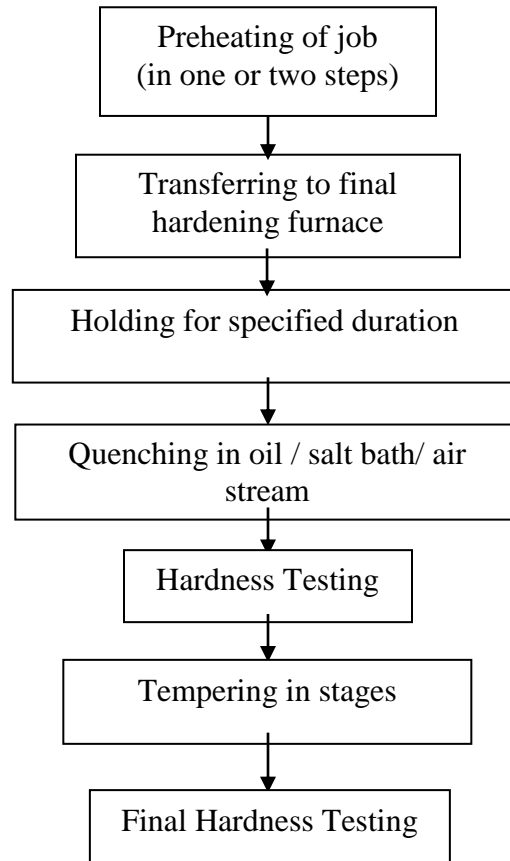
Range of desired depth of hardening (mm)	Frequency required (Hectares)	Range of power input required (KW)
0.5-1.1	450	15-19
1.1-2.3	450	08-12
1.5-2.3	10	15-25
2.3-3.0	10	15-23
3.0-4.0	10	15-22
3.0-4.0	3	22-25
4.0-5.0	3	15-22

After hardening, component is tempered in tempering furnace maintained at 220 deg. C with sufficient soaking time. This result into relieving stresses / brittleness of the material.

**b) Quality Specification:**

The quality standards are to be maintained as per customer's requirement and depends mainly on composition of raw material, heat treatment process followed thereby to achieve desired physical & metallurgical properties.

6. **PROCESS FLOW CHART:**



7. **PRODUCTION CAPACITY:**

Qty. = 30,000 Nos. of Crank Pin per annum

Value = 22,50,000/-

8. **MOTIVE POWER REQUIREMENTS:** = 60 KW

9. **POLLUTION CONTROL MEASURES:**

There is no such pollution involved in the process, however, NOC is required to be obtained from the State Pollution Control Board before the commencement of the production.

10. **ENERGY CONSERVATION:**

Sincere efforts towards energy conservation are being needed to optimize the quality production.

The energy audit an integral part of an energy conservation project, may sometimes very helpful in minimizing waste product for cleaner production. Factors, which affect fuel economy, are –

- Heat distribution
- Operation temp. grade & quality of raw material
- Quenching method

**11. FINANCIAL ASPECTS:**

**Fixed Capital:**

**i) Land & Building:**

Covered area: 500 Sq. meters (Rented/month)

Rs.7, 000/-

**ii) Machinery & equipment:**

Sr.No.	Description	Imp/Ind.	Qty.	Value(Rs.)
1.	Medium frequency induction hardening furnace alongwith temp. & electric control panels i) Capacity : 20 KW ii) Capacity : 40 KW	Ind.	1 } 1 }	3,00,000/-
2.	Tempering furnace alongwith temp. control panel, chamber size 4'x3'4'	Ind.	1	50,000/-
			<b>Sub-Total</b>	<b>3,50,000/-</b>
b)	Testing equipments			
1.	Metallurgical Microscope	Ind.	1 Set	75,000/-
2.	Rockwell hardeners testing machine	Ind.	1 Set	50,000/-
3.	Polishing equipments	Ind.	1 Set	7,000/-
4.	Welding Transformer, 300 Amp., Oil cooled	Ind.	1 Set	9,000/-
5.	Standard size jigs/fixtures & other handling equipments			10,000/-
			<b>Sub-Total</b>	<b>5,01,000/-</b>
c)	Electrification & installation of machines @ 10% of above cost			50,100/-
e)	Furniture & other office equipments			75,000/-
f)	Pre-operative expenses			50,000/-
			<b>Total:</b>	<b>6,76,100/-</b>

**12. WORKING CAPITAL (Per Month):**

**(A) Staff & Labour (P.M.):**

Sr.No.	Designation	No. of Persons	Salary (Rs.)	Amount (Rs.)
1.	Manager	1	7,000/-	7,000/-
2.	Supervisor	1	5,500/-	5,500/-
3.	Skilled workers	2	3,000/-	6,000/-
4.	Semi-Skilled workers	2	2,500/-	5,000/-
5.	Unskilled workers	2	2,200/-	4,400/-
6.	Accountant-cum-office assistant	1	4,000/-	4,000/-
7.	Peon/Watchman	2	2,000/-	4,000/-
			<b>Total:</b>	<b>35,900/-</b>
			<b>Add. Perquisites @ 15% of Salary</b>	<b>5,385/-</b>
			<b>Total:</b>	<b>40,250/-</b>

**(B) Raw Material & Consumable (P.M.):**

Sr.No.	Description	Qty.	Value (Rs.)
1.	Servo quench oil @65/ltr.	150 Lit.	9,750/-
2.	Binding Wires @45/Kg	50 Kgs.	2,250/-
3.	Testing chemicals (Consumable)	--	3,000/-
		<b>Total:</b>	<b>15,000/-</b>

**(C) Utilities (P.M.):**

1.	Electricity 9000 KWH @ Rs. 4.50/Unit	45,000/-
2.	Water	5,000/-

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**Total: 50,000/-**  
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**(D) Other Contingent Expenses (P.M.):**

Sr.No.	Description	Amount (Rs.)
1.	Rent	7,000/-
2.	Telephone, Postage stationery	3,000/-
3.	Advertising	2,000/-
4.	Insurance	5,500/-
5.	Repair & Maintenance	4,000/-
6.	Consumable stores	2,000/-
7.	Transportation	3,000/-
8.	Misc. expenses	4,000/-
	<b>Total:</b>	<b>30,500/-</b>

13. **TOTAL WORKING CAPITAL (Per Month):** 1,36,785/-

14. **TOTAL CAPITAL INVESTMENT:**

i)	Fixed Capital	6,76,100/-
ii)	Working Capital for 3 months	4,10,355/-

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**Total: 10,86,455/-**  
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15. **FINANCIAL ANALYSIS:**

a) **Cost of Production (Per Annum):**

Sr.No.	Description	Amount (Rs.)
1.	Recurring expenses per annum	16,41,420/-
2.	Depreciation on machines & equipments @ 10%	15,100/-
3.	Depreciation on induction f/c. @ 20%	70,000/-
4.	Depreciation on Office furniture & equipments @ 25%	15,000/-
5.	Interest on total capital investment @ 12% per annum	1,30,375/-
	<b>Total:</b>	<b>18,71,895/-</b>

**b) Turnover (Per Annum):**

By sale of 30,000 Nos. of Crank Pin @ 75/- each= **22, 50,000/-**

**c) Net Profit (Per Year):**

= Turnover – cost of Production Per year = **3,78,105/-**

**d) Net Profit Ratio:**

=  $\frac{\text{Net Profit / year}}{\text{Turnover per year}} \times 100 =$  **16.80%**

**e) Rate of Return:**

=  $\frac{\text{Net Profit}}{\text{Total Capital Investment}} \times 100 =$  **34.80%**

**f) Break-Even-Analysis:**

**Fixed Cost Per Annum:**

i) Rent / annum	1,44,000/-
ii) Depreciation on machines & equipments@10%	15,100/-
iii) Depreciation on Furnace @20%	70,000/-
iv) Depreciation on office furniture & equipments @20%	15,000/-
v) Interest on total capital investment @12 %	1,30,375/-
vi) Insurance	66,000/-
vii) 40% of salary & wages	1,98,168/-
viii) 40% of other contingent expenses	86,400/-

**Total:** **7,25,043/-**

**Break-Even-Point:**

=  $\frac{\text{Fixed Cost}}{\text{Fixed cost + Profit}} \times 100$

= **65.72 %**

**NAMES & ADDRESSES OF MACHINERY AND RAW MATERIAL SUPPLIERS :**

1. M/s. Hannu Metallurgical,  
B-22,Girikunj Industrial Estate, Chakala, Mahakali Caves Road,  
Andheri (East), Mumbai – 93 Ph.no. (022)-26875545.
2. M/s. Mahavir Engineering Corpn.,  
1, Ambica Estate, B/h. Agarwal I.E.,  
off S.V. Road, Jogeshwari West,  
Mumbai – 102. Ph.no. (022)-56992785
3. M/s. Divecha Electricals,  
Balaji Indl. Complex,  
Gala No. ½, Navaghar , Bhayandar (E), Distt. Thane.
4. M/s. Nisha Engrs. & Consultants  
Nisha Enclave, Plot No. 95,  
Sector 23, Cidco Indl. Area,Turbhe, Distt. Thane.Ph.no. (022)-27684697
5. M/s. Combustion Equipments & Instruments,  
Jer Mahal, Dhobi Talaw, 1<sup>st</sup> Floor,Mumbai –2. Ph.no. (022)-27690171/27600842.
6. M/s. AIMIL Ltd.,  
Malhotra House, Opp. G.P.O.,  
Walchand Hirachand Marg,Mumbai – 1. Ph.no. (022)- 22642435
7. M/s. Electroil Super Thermal Engineers,  
151, Small Factory Area, Lakadganj,Nagpur – 8. Ph.no. (0712)-2286284
8. M/s. G.R.C.  
1, Taratala Road,  
Kolkata-700024.
9. M/s. Standard Electricals  
282, B.B. Chatterjee Road,  
Kolkata-700042. Ph no. (033)- 24422063
10. M/s. Associated Engineers  
32, G.C. Avenue,  
Kolkata-13. Ph. No. (033)-40066117, 22126477, 24731518
11. M/s. Machine Tools Impex  
75, S.C. Avenue,  
Kolkata-700013. Ph no. (033)- 22377569, 65481114
12. M/s. Rana Udyog (P) Ltd.  
NH-6, Vill.: Sulati, Dhulgarh,  
Howrah -711303. Ph.no. (033)- 26617891

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