



*Many issues can be solved with quick detection and determination of problem's cause, followed by prompt corrective action.*

## Troubleshooting induction hardening problems – Part III

In previous columns, I have provided some detail on the sources of problems with induction hardening. While I have tried to be inclusive, there are many sources of problems with induction hardening that are not limited to quenching. In this column, I am providing a summary of the possible problems, possible causes, and a list of possible corrective actions. This list is not inclusive but should cover most of the induction-hardening related problems.

I hope that this chart will be of benefit in reducing induction

hardening problems. Should you have any comments, or suggestions for future columns, please contact the author or the editor. ✉

### ABOUT THE AUTHOR

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PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION	
Distortion and Cracking	Low concentration	Increase concentration by adding polymer	
	Incorrect quenchant	Change to proper polymer (slower)	
	Low quenchant temperature	Increase quenchant temperature	
	Low part exit temperature	Increase concentration Shorten time in quenchant	
	Degraded quenchant	Dump and recharge	
	Overheated part	Reduce heating and heating dwell time Verify part centered in coil or uniform spacing from coil Verify that proper coil is used Verify that proper program is used for part Verify power supply is operating within specification Increase delay before quenching dwell time	
	Material defect	Check for laps and seams in part Verify no gouging or machining tool marks	
	Non-uniform agitation	Verify operation of quench ring Verify no clogged holes Improve uniformity of quenchant	
	Corrosion	Inhibitor depletion	Add recommended corrosion inhibitor per quenchant manufacturer's suggestions
		Low polymer concentration	Increase concentration
Biological contamination		Add biocide Use biostable quenchant	
Material incompatibility (machine)		Add recommended corrosion inhibitor per quenchant manufacturer's suggestions Verify equipment grounds	
Contamination (inorganic build-up)		Use reverse osmosis (RO water) as make up or initial charge Monitor fluid conductivity Partial dump and recharge using RO water Verify water softeners or RO generation units working properly Add recommended corrosion inhibitor per quenchant manufacturer's suggestions	

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION	
Excessive Drag-Out or Consumption	High part exit temperature	Increase dwell time in quench Decrease concentration	
	High polymer concentration	Decrease concentration Change to lower solids polymer	
	Insufficient drainage	Increase drainage dwell time Use air knife to clean parts and reduce polymer consumption	
PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION	
Low Hardness or Properties	Incorrect quenchant	Use proper quenchant	
	Too high concentration	Add water to reduce concentration	
	Quenchant temperature too high	Reduce temperature	
	Inadequate quenchant agitation	Verify quenchant flowing uniformly (no holes plugged) Increase flow or pressure	
	Underheated part	Increase heating or dwell time Verify power supply is operating within specification Verify proper coil and program are used for hardening operations Verify distance from coil	
Contamination	Clean parts prior to induction hardening Verify skimmers working properly Eliminate contamination (dump and recharge)		
PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION	
Biological and Odor Problems	Microbiological contamination	Add biocide Clean system removing biomass Use biostable quenchants Examine source and treat with biocide Eliminate contamination of quenchant by coolant Clean parts prior to induction hardening Filter quenchant to 6-8 microns Agitate system on regular basis	
		High part exit temperature	Increase dwell time in quench Decrease concentration
		Polymer on tempered part	Clean part prior to tempering Use air knife to clean parts and reduce polymer consumption Increase ventilation
		Poor ventilation	Increase ventilation over induction hardening machine and temper furnace
		PROBLEM	POSSIBLE CAUSE
Foaming	Air entrainment	Verify system quenchant level Verify pump seals Verify no vortex on inlet Reduce spray pressure Add defoamer	
	Contamination	Clean parts prior to induction hardening Verify skimmers working properly Eliminate source of contamination Add defoamer	
	Low quenchant level	Increase quenchant level Verify no inlet vortex Add defoamer	