TB0238 Fault Finding 300Hz Spindles

Faults on the 300Hz spindle circuit have proved to be very difficult to trace. There symptoms are quite straight forward, but failing to find the real root cause has created huge costs in revisits and destroyed components. It is vital that all root causes are examined and eliminated, as there is often more than one root cause and very often they are intermittent.

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Technical Bulletin

TB Number:	238			
Originator:	Gareth Green			
Machine:	High Speed Spindle Ring			
Date:	27/11/13			
Circulate to:	Service			
Title:	Fault Finding 300Hz Spindles			
Version Info	1	GG	27/11/13	Original Version
	2	GG	17/07/14	CUB inverter issues; DC Injection braking
	3	GG	04/08/14	Soldering of termination on Ring connection Relay PCBs Mechanical interlock on 50hz / 300Hz Resistor value on CUB / VXM
	4	GG	25/02/16	Illegal spindle control commands in mnd file

Detail

Faults on the 300Hz spindle circuit have proved to be very difficult to trace. There symptoms are quite straight forward, but failing to find the real root cause has created huge costs in revisits and destroyed components. It is vital that all root causes are examined and eliminated, as there is often more than one root cause and very often they are intermittent.

Symptoms

Code	Description
SP001	Elte Spindle Overheating / Smoking
SP002	Tools Breaking
SP003	Spindle not plunging or not fast enough
SP004	Tool Stalling While Cutting
SP005	Spindle Not Starting
EL003	Inverter Smoking / Exploding
EL001	Main Fuse in Factory Trip

Actions / Checks

Code	Description	Tick
CHK_CL001	Check for evidence of water in electrical cabinet	
CHK_PA001	Check Inverter Accel / Decel Parameters match front end. See TB234	
CHK_PA002	Check Inverter Parameter Settings Particularly F20, F21, F22 **MUST BE ZERO**	
CHK_PR001	Check Profile is not wet when put on machine	
CHK_SP001	Check connections in spindle motor terminal boxes. Check for stray strands of wire or any evidence (Blackness / smell) of arcing to case. Check for nuts or washers floating around	
CHK_SP002	Check Elte Motor connection nuts by removing and refitting (The lower nut has been found to be loose in many cases)	
CHK_SP003	Check cables for insulation damage under shrink wrap as it enters Elte motor. (The inner core is often cut into when outer sheath originally removed)	
CHK_SP004	Check ring cables and energy chain for damage. Be thorough. Disconnect and pull it all out. Check the ring plug for arcing	
CHK_SP005	Check spindle plunges freely on slideways	
CHK_SP006	Check inverter alarm input is working and enabled in alarms	
CHK_SP007	Test on windings of each spindle motor for equal resistance across each phase pair	
CHK_SP008	On ZX/ Microline, check 300/50 Hz Contactor function for bad / welded phasesCheck that the mechanical interlock is fitted and working to mechanically prevent both relays switching on	
CHK_SP009	Check Spindle (Shrack) relay and base for blackened / welded contacts and check all 3 phases make contact On ZX / Microline check each of the Spindle Card relays for full on / off function of each phase relay (requires removal). Check for signs of blackening or PCB damage, particularly if the relays have been desoldered and replaced	
CHK_SP010	Check Inverter breaking resistor is fitted and is correct value – 160R on VXM, 2 x 100R in series on CUB	
CHK_SP011	Check Spindle Card relays are all functioning - 3 contacts all off and on	
CHK_SP012	Check Spindle Tool Plunge sensore fitted and working	
CHK_SP013	Check cutters/ sawblades are not blunt and are Stuga branded	
CHK_SP014	Check direction of spindle motors	
CHK_SP016	Check for water in spindle motor	
CHK_SP018	Check for trapped wires under spindle access covers	
CHK_SP019	On a Flowline Mk3 ring refurb upgrade, check the 50Hz / 300Hz changeover relay	
CHK_SP020	On a Flowline Mk3 ring refurb upgrade, check the feedback wire has been fitted and alarm has programmed in front end. See TB0219	
CHK_SP021	Check Ring connection (green connector at top of ring) plug solder joints – particularly under heatshrink – cause of failure on M006	

CHK_SP022	Check mnd files for legacy ou.SMOT commands. This is a legacy issue that overcame software problems, but on all winMulti machines, dp.n=off or dp.n=half should be used (n is the spindle number). Using SMOT in the wrong way creates the wrong sequence of events	

Historical Inverter Issues

There have been 5 types of inverter used.

1. Jaguar CUB

This was the original inverter. It is not capable of switching two types of motor and is used in 300Hz mode only on ZX machines up to Z025 and Microlines up to M009.
The original design intent was to use “DC Injection Braking” to try decelerate the spindle motors quickly. This was not particularly effective.

2. Jaguar VXM

The CUB was upgraded to a VXM to give better deceleration control. The drive company (IMO) was tasked with designing the best possible system to decelerate two Elte 0.75kW motors to standstill in less than 250ms. IMO specified the new value dump resistor (160 ohm). The “DC injection braking” is not used.
In later designs, including the Flowline Mk3 High Speed Spindle Upgrade and new Autoflows, the inverter is used to provide dual frequencies (50Hz for V notching and 300Hz for Spindles).

> ...Jaguar VXM Inverter is now obsolete and has to be replaced with Yaskawa

3. VACOM

This was only used a handful times as it was superseded by the Delta

4. Delta

The Delta was chosen because it had a PLC on-board which allowed some signal processing. This was to allow the inverter to change the overload current if more than one spindle is used in a double plunge scenario. Previous to this change, the overload value was set to 2x the peak current, which created the issue of quickly burning out spindle motors in an overload situation
Regrettably, these inverters proved very susceptible to short circuits or missing phases, and tended to fail spectacularly with no idea of the root cause of the fault. They are being replaced with Yaskawa inverters when they fail.

5. Yaskawa

The Yaskawa has proven to be much more bullet-proof in short circuit scenarios. It also has a small PLC code facility and has been programmed with an output signal to indicated back to the PLC that the deceleration phase has finished. This is used to ensure there is no residual current when the relay contacts are opened, which causes blackening of the relay contacts.
Parameters B2 -02 and B2-04 set to 0

Important Changes On winMulti Upgrade

If a windows upgrade is carried out on a CUB inverter system, two very important changes must be made to the parameters settings

1. All DC injection braking parameters in the CUB inverter (F20, F21, F22) must be set to zero
2. The CUB is not capable of deceleration as well as the VXM, so the deceleration parameter (F08) should be set to 0.6, and the winMulti parameter ps_InvDecel300Hz should be set to 600