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| **Function** | **Failure Mode** | **Effects** | **Severity** | **Cause(s)** | **Occurrence** | **Current Controls** | **D** | **CRIT** | **RPN** | **Recommended Actions** | **Responsibility** | **Action Taken** |
| Hard constraint prevents surface penetration | Motor fails to supply required counter-torque | Gross mistakes in surface cutting | 8 | Underestimate of motor torque requirements and/or defective motor components | 2 | Safety factor of at least 5 on motor torque requirement | 8 | Detection requires setting a lower limit based on each surface input | 128 | Ensure proper setup and adjustment of motor to receive specified performance |  |  |
| Hard constraint implementation device (bolt) yields | Free-fall of cutting tool onto surgical work area | 10 | Improper design of implementation device and/or underestimation of required force it must proved | 1 | Real life example (from last year) has been used extensively and shows no deficiency | 8 | Detection requires setting a lower limit based on each surface input | 80 | Set up a periodical check up on the implementation mechanism to maintain its performance |  |  |
| Motor loses power supply | Free-fall of cutting tool onto surgical work area | 10 | Improper placement of wiring and miscalculation of required slack in the cords | 3 | Robust and rigid connection cables with excess slack | 5 | Detection requires continuous checkup on the strength and “secure-ness” of the connections | 150 | Come up with a simple and cheap method to hold cables and wiring in place but does not make them overly taught and restrictive to motion |  |  |
| Hard constraint position is updated to counteract a dynamic (moving) load | Motor fails to move hard constraint fast enough to the updated position | Gross mistakes in surface cutting | 8 | Underestimate of motor speed requirements and/or defective motor components | 5 | Safety factor of at least 3 on motor speed requirements | 8 | Detection requires measurement of consistent surface penetration as a result of slow speed updating | 320 | Reduce the actuation link (attached to the motor) in order to the reduce the time required for the hard constraint to move to position |  |  |
| Motor loses power supply | Gross mistakes in surface cutting | 10 | Improper placement of wiring and miscalculation of required slack in the cords | 3 | Robust and rigid connection cables with excess slack | 5 | Detection requires continuous checkup on the strength and “secure-ness” of the connections | 150 | Come up with a simple and cheap method to hold cables and wiring in place but does not make them overly taught and restrictive to motion |  |  |