Completing Risk Assessments

The intent of this document is to use a flowchart approach with descriptions / comments to assist the facilitator and team.

Step 1: Enter the application, asset tag number, company, description, participants and revision history. Refer to the information below for assistance.

Application: **Asset Tag No:** "SD-123456" or "TBD"

Enter the "part" / "machine or equipment" / "program" (e.g. lower jacket / assemble bench / xyz-221).

Company:

Delphi-(AHG, E/EA, E&S, PT, S, or T), plant no. by "Supplier Name" (e.g. ATS)

Description:

Describe operator interaction and sequence of operation of the machine (e.g. unload assembly, load tube, load bracket, initiate cycle, close door, advance clamp, weld tube to bracket, and retract clamp, and open door)

Notes:

"Add note(s) where required to clarify the risk assessment"

Analyst Name(s):

Enter "name - role" of those participating in the risk assessment (e.g. John Doe - Mfg Engr or ME)

Revision History:

"date"	Initial Risk Assessment
	Revised per equipment modification …
	Risk assessment based on machine xyz, date

Form Revised: 11/08/04

Controls Notes (auto generated):

"This tool will automatically generate control notes based on the category and solution selected." **Do not enter information in this area!**

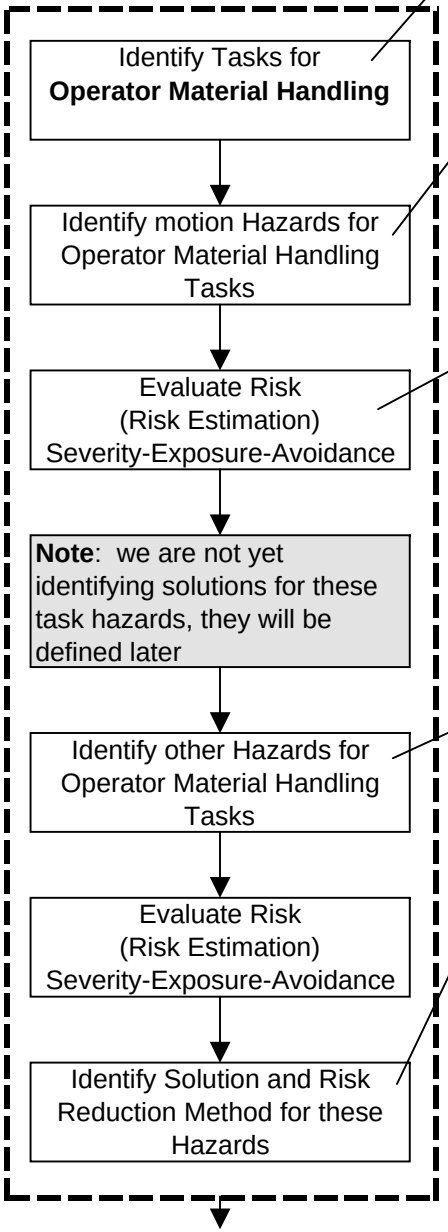
Step 2: Follow the risk assessment flowchart on the following pages for assistance. Note that this flowchart is included as part of the risk assessment toolkit. The information here is available via embedded comments in the flowchart.

Toolkit Notes:

1. Several drop down boxes are provided to reduce the amount of data entry and to facilitate risk assessment consistency. In addition, the drop down serves as a thought starter and will assist with the completion of a thorough risk assessment.

2. The worksheet has embedded formulas and validation boxes that rely on hidden columns and a hidden worksheet. **When inserting rows, always copy a blank line and then use the insert menu to insert copied cells or right click and select insert copied cells**

Revised 19SE06



Tasks include:
- load/unload part
- operator assemble part
- drive fastener
- reject bad part

List all **unexpected** advance, raise, close, rotate, etc. **motions** that the operator is exposed to:
- if the motion creates a bump, pinch, crush, cut, sever, puncture, entanglement, etc., estimate the risk (i.e. S, E, A)
- if the motion is **not** hazardous, enter "no hazard" in the risk reduction method

Severity:
S2 Serious Injury - Normally irreversible including death
S1 Slight Injury - Normally reversible
Exposure:
F2 Frequent - Frequent to continuous (>1/hour) and/or the exposure time is long (>15 min)
F1 = Infrequent - Seldom to less often (<1/hour) and/or the exposure time short (<15 min)
Avoidance:
P2 Not Likely - Scarcely possible
P1 Likely - Possile under specific conditions

Ergonomics
Thermal: Hot Parts, Hot Surface
Part handling: sharp edge or burr, oil on part, coolant on part
Slips/Trips/Falls/Egress:

1. **Ergonomics** - refer to Design-In Ergonomics checklist.
   Note: Safeguarding and process solutions addressed below may in turn create ergonomic issues, e.g. safe-distance placement of light curtains.
2. **Thermal** - add warning signs, wear gloves, etc.
3. **Parts** - wear gloves, train how to grip, etc
4. **Slips** - 5S, address floor, run dry, etc.
5. **Trips** - ramps, move out of path, etc.
6. **Falls** - refer to Design-In spec for platform and climbing device requirements.
7. **Egress** - refer to H&S for egress requirements

Risk Reduction Method for Task-Hazard (i.e. Solution Loop)

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Severity of Injury	Exposure	Avoidance	Risk Reduction Category
S2 Serious	F2 Frequent	A2 Not Likely	R4
		A1 Likely	R3C
	F1 Infrequent	A2 Not Likely	R3B
		A1 Likely	R3B
S1 Slight	P2 Frequent	A2 Not Likely	R3A
		A1 Likely	R2B
	P1 Infrequent	A2 Not Likely	R2A
		A1 Likely	R1

Risk Estimation
(for each Task-Hazard)
Severity-Exposure-Avoidance

Has acceptable risk been achieved?

Yes
R1 or R2

Apply Safeguards and Control Circuits

No
R3 or R4

Can the hazard be eliminated or reduced by Design?

No

Yes

Design-out hazard

If hazard is reduced, re-evaluate

Team is to make every effort to mechanically design out the hazard, reference great ideas on ME web site.

R4
1. Hazard Elimination or Substitution
2. Use R3 Engineering Controls w/ R2/R1 provisions to safeguard residual risk

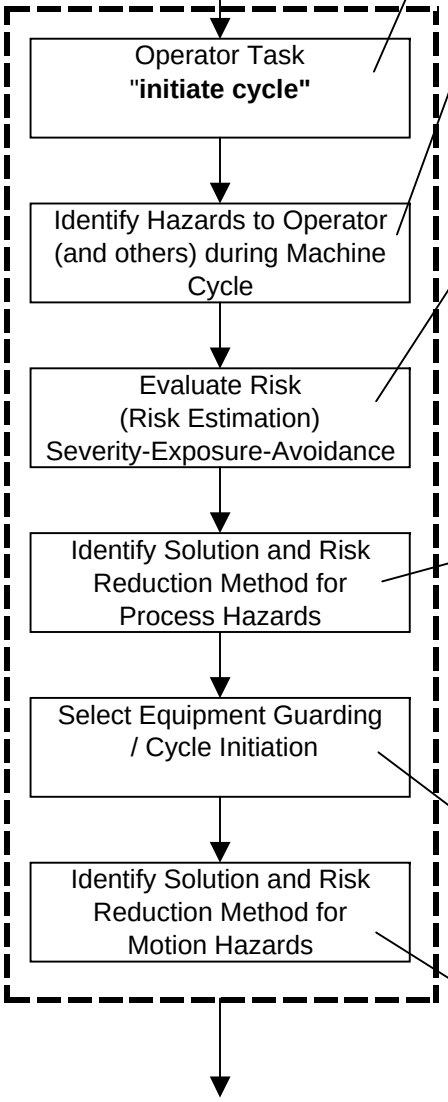
R3
1. Prevent access to hazard
   - Fixed Barrier
   - Interlocked guard / door
2. Stop Hazard
   - Two Hand Control
   - Light Curtain
   - Safety Mat
   - Other PSD

R2
1. Non interlocked barrier
2. Clearance
3. Warnings (see 8.6)
4. Training & Procedures

R1
1. Personal Protective Equipment

If the guarding method creates another hazard, this hazard(s) needs to be added as additional line(s) on the risk assessment.
Example:
1. Risk Reduction Method:
- fixed guard 3 sides w/ horizontal door
2. Motion creating bump, pinch, or crush hazards:
- unexpected advance motion of door
- expected advance motion of door
- expected retract motion of door

Risk Assessment Flowchart



The intent here is to analyze the hazards associated with the machine cycle. If the machine is a continuous cycle machine (i.e. manual load/unload of parts does not take place each cycle of machine), then this should be the starting point for the risk assessment.

1. List all **expected** advance, retract, raise, open, close, rotation, etc. **motions** that the operator and others are exposed to during the machine cycle:
 - if the motion creates a bump, pinch, crush, cut, sever, puncture, etc., estimate the risk (i.e. S, E, A)
 - if the motion is not hazardous, enter "no hazard" in the risk reduction method
2. **Process Hazards**
 - Chemical/toxicity exposure; oil, coolant, mist
 - Noise
 - Projectile: flying chips, weld splatter, parts, tools, hot plastic, etc.
 - Weld Flash, Lasers, etc.

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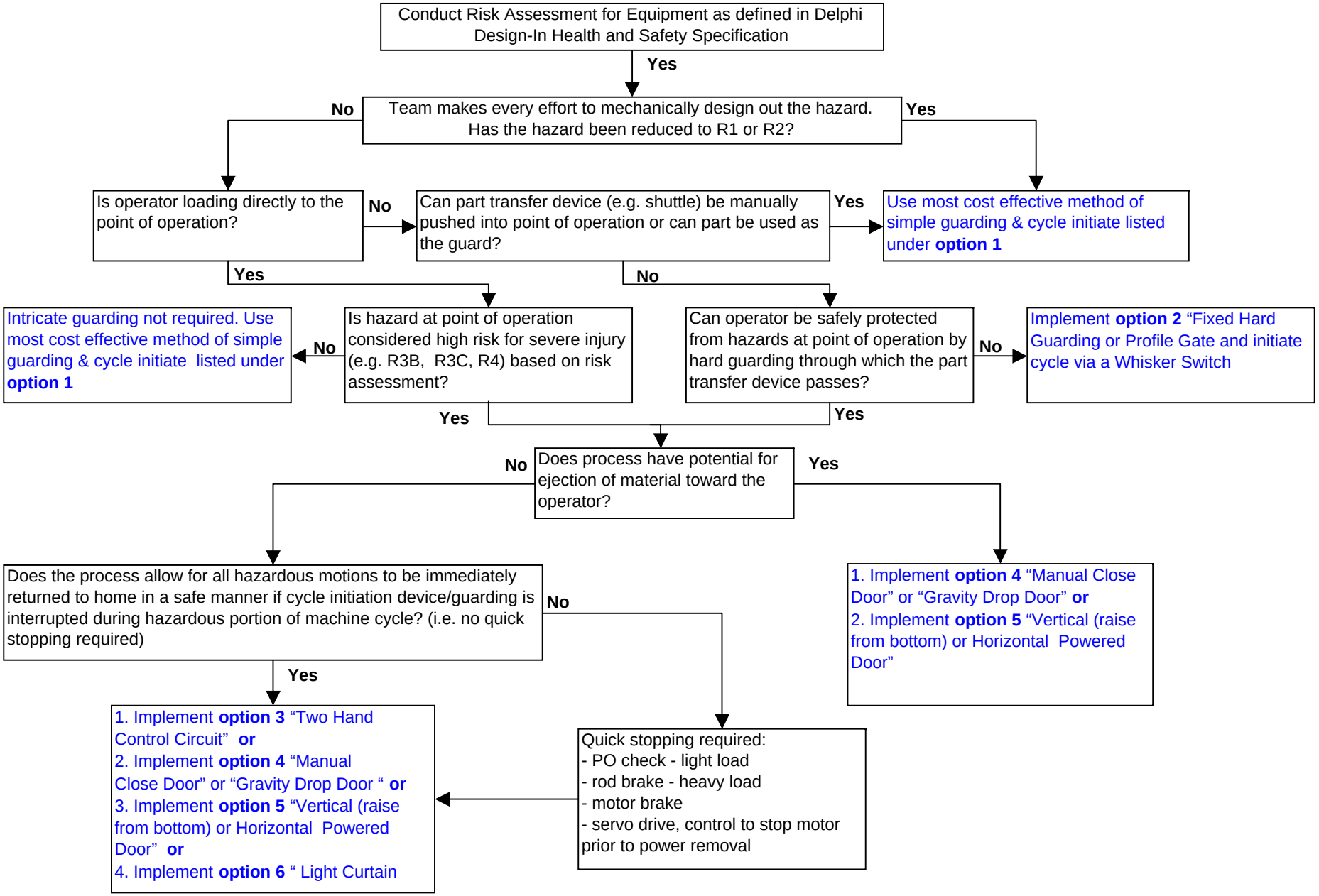
Process Hazards:
1. Noise - design out or abate
2. Part Ejection (Projectile) - fixed guard w/door
3. Chips, Weld Slag, Hot plastic - fixed guard w/ door
4. Weld Flash, Lasers, etc. - weld curtain, fixed guard w/ door
5. Oil Coolant - fixed guard w/ door
6. Oil / Coolant Mist - mist removal system

1. Solutions to the process hazards established above may constrain the guarding selected.
2. Utilize "Guarding / Cycle Initiation Decision Tree".
 Note: This process assists in selecting the optimal solution.

Motion Hazards:
1. Fixed guard
2. Fixed guard 3 sides w/ door (vert drop, vert raise, horizontal)
3. Fixed guard 3 sides w/ two-hand control
4. Fixed guard 3 sides w/ Light curtain

Guarding / Cycle Initiate Methodology



Option 1:
- Use **part as the guard**, part presence switch allowed to initiate cycle
- **Load directly to point of operation**, part presence switch initiates cycle
- **Load part just above the point of operation**, let gravity index the part into the pinch point
- **Load to fixture, manual pull head over part**, switch on slide initiates cycle, head spring returns upon release
- **Load to nest, manually push nest** into point of operation w/ **guarding** traveling with nest and **sliding up via a ramp**
- **Load to nest, manually push nest** into point of operation w/ **guarding** traveling with nest and **sliding up via a ramp. Nest retracts automatically after cycle complete**

Option 2:
Load to part transfer device, initiate whisker switch and have transfer device **index through fixed guarding or with use of profile gate** (hinged w/ interlock)

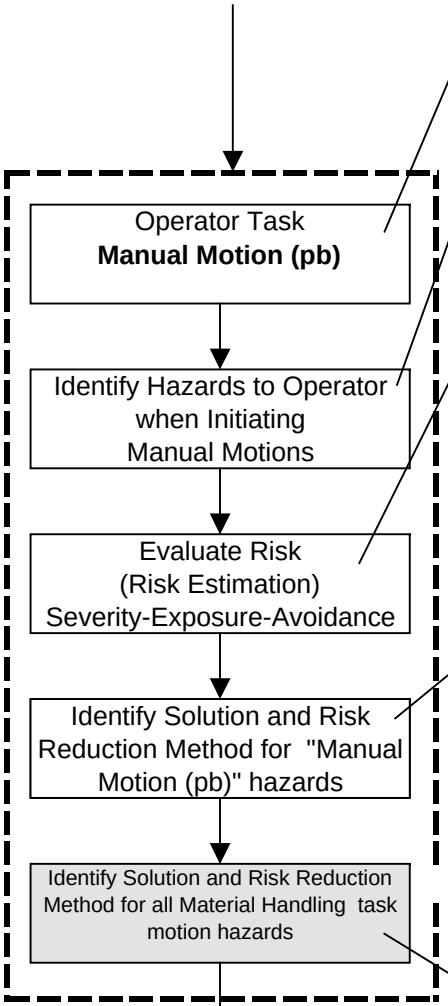
Option 3:
Load directly to point of operation, initiate cycle via **two-hand control circuit**

Option 4:
- **Manually Close Door** and **Manually Open Door** when cycle complete
- **Manually Close Door** and **Door opens automatically** when cycle complete
- **Gravity (vertical) drop door** with **whisker switch** (or other) for cycle initiation

Option 5:
- **Fully powered**, Vertical (Raise from Bottom) or Horizontal **Door** with **whisker switch** (or other) for cycle initiation

Option 6:
- **Light Curtain** with **whisker switch** (or other) for cycle initiation
- For Light Curtain cycle initiation, refer to ***Application Guideline for PSDI using Light Curtains*** , DA-2101 white paper

Note: All control circuits are to be implemented consistent with the ***Specification for the Application of Safety Circuits*** , DA-2001



Manual motions initiated at the operators council for each of the motions.

List all expected advance, retract, raise, lower, open, close, rotation, etc. motions that the operator and others are exposed to during the machine cycle:
- if the motion creates a bump, pinch, crush, cut, sever, puncture, etc., estimate the risk (i.e. S, E, A)
- if the motion is not hazardous, enter "no hazard" in the risk reduction method

Note: Generally the expected motions in the "initiate cycle" task can be copied here.

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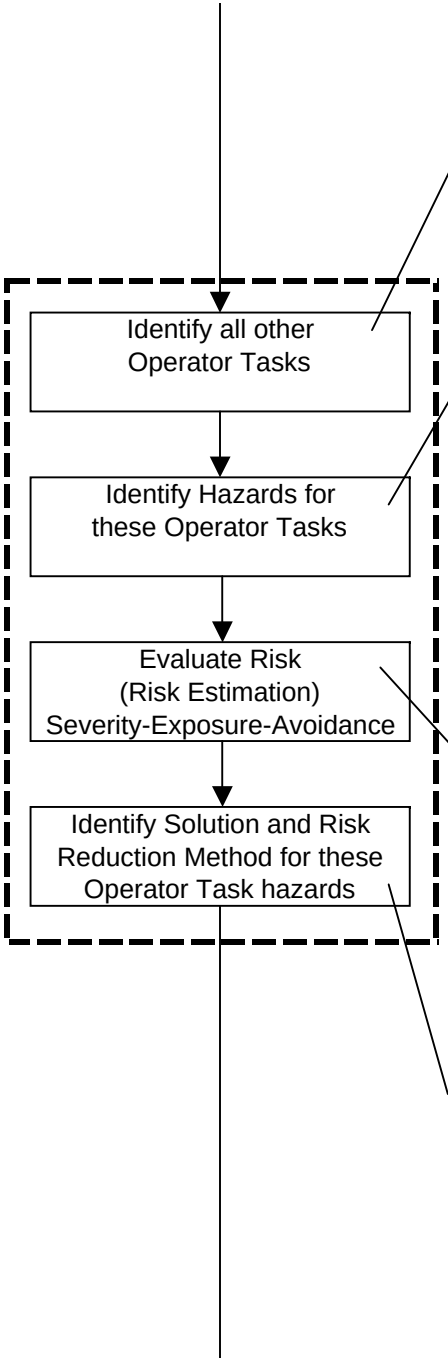
Generally, the **safeguarding** solution for machine cycle is used for manual motions. The following questions will aid in determining if this is appropriate:
1. If a door is used, can manual motions be initiated with the door closed? This simplifies the controls design.
2. Is access to the hazardous area required after initiated motion is complete? Power to hazardous motions (electrical & fluid) is only available while motion is manually initiated (e.g. close clamp pb initiated).

Note: Check with your controls engineer to see if applicable "how to" document(s) are available.

With the safeguarding known for the machine cycle and manual motion initiation, a solution and risk reduction method for the operator material handling task-hazards can now be determined.
1. Fixed guard
2. Fixed guard 3 sides, w/ interlocked door
   - Fixed guard 3 sides, w/ interlocked door & rod brake (vertical cyl - heavy load)
   - Fixed guard 3 sides, w/ interlocked door & PO check (vertical cyl - light load)
3. Two-hand control (with vertical cyl considerations)
4. Light curtain (with vertical cyl considerations)

Note: Consideration needs to be give to motion stop times. The only exception to this is if the safeguard is an interlocked door, locked close. Check with your controls engineer to see if applicable "how to" document(s) are available.



Tasks include:
- clear jams
- verify calibration
- tool change
- operator intervention
- blow-off chips

1. An analysis needs to be made for each task to understand if task can be preformed with the current safeguarding in place and constraints on manual motions. If so:
 - refer to operator-hazards: "manual motion (pb)" task
2. Generally, for manual load / manual load - auto unload, the hazards that the operator is exposed to for these tasks is the same as the operator material handling and manual motion (pb) tasks. The respective solutions normally will be ok since these tasks are less frequent. If so:
 - refer to operator-hazards: "load/unload part" task
 - refer to operator-hazards: "manual motion (pb)" task
3. For automated equipment, further analysis is required to understand and document applicable hazards.

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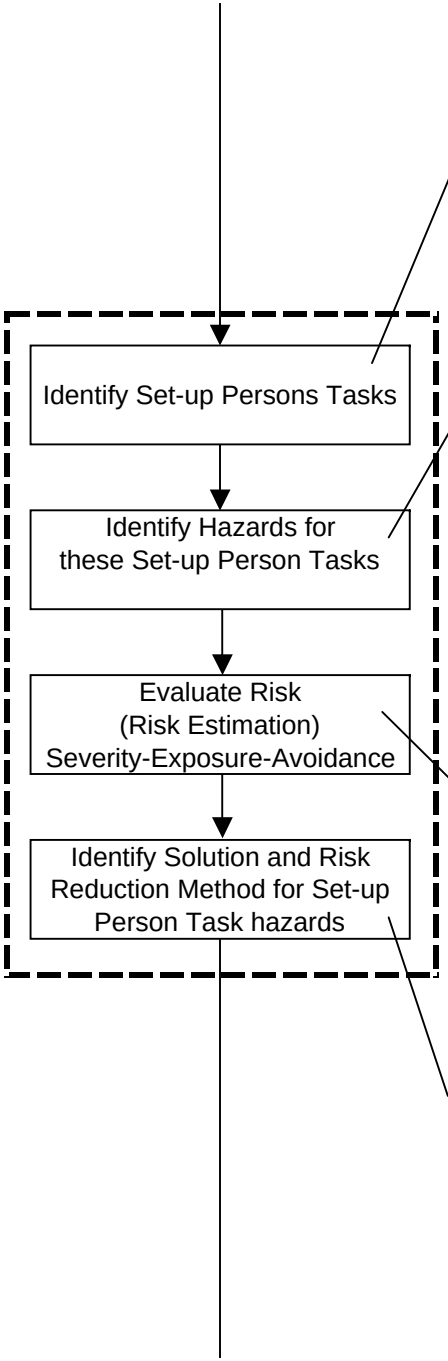
Where the hazards are the same as operator material handling or manual motion (pb) tasks, the respective solution and risk reduction method will be the same. In this case, leave the solutions field blank and enter in the risk reduction method:
- refer too respective task-hazard solutions



Tasks include:
- changeover
- calibrate/set-up
- lubricate machine
- program/teach/jog

Note: in many case these tasks will be completed by the operator and should be added to the operator task list.

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 - refer to operator-hazards: "manual motion (pb)" task
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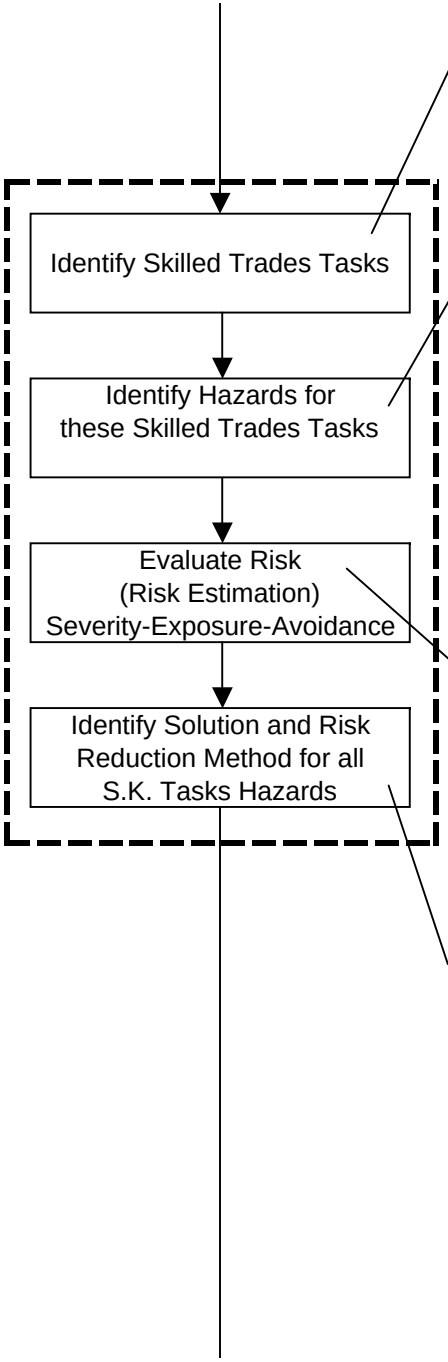
 - refer to respective task-hazard solutions
2. Where teach/jog requires the person to be in the motion path, speed shall be limited and pendant station or enable device should be used to ensure that the person can stop the motion.



Tasks include:
- troubleshooting
- adjust control components
- mechanical adjustments
- preventive maintenance
- major repair/component replacement

1. Troubleshooting - skilled trades are generally exposed to the same hazards as the operator / set-up person tasks. The respective solutions normally will be ok since these tasks are less frequent. If so:
 - refer to operator-hazards: "load/unload part" task
 - refer to operator-hazards: "manual motion (pb)" task
 - etc.
2. An analysis of the hazards for adjust control components, mechanical adjustments and preventive maintenance tasks is to be completed.
3. For the task of major repair/component replacement, skilled trades are exposed to all of the operator / set-up person hazards. In addition, they are exposed to hazards such as confined space, electrical shock & arc flash and stored energy.

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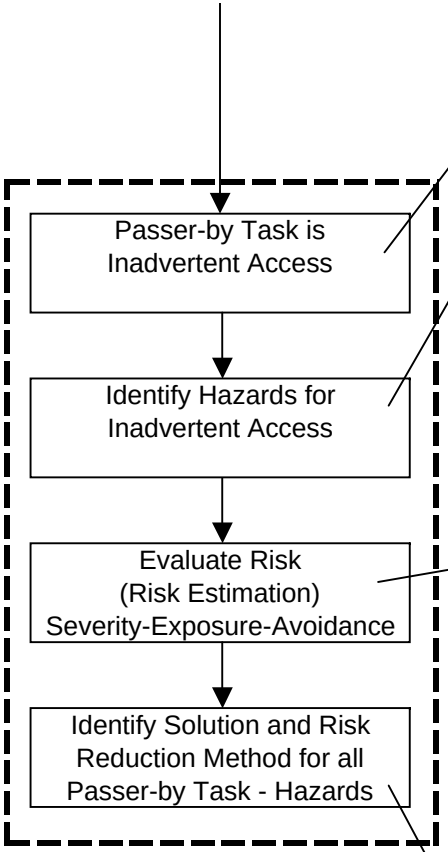
1. Troubleshooting - the operator / set-up person task-hazards respective solutions generally provide appropriate safeguarding.
2. Adjust control component - where possible mount these components outside of the safeguarded area.
3. Mechanical adjustments - to accomplish these types of adjustments, the skilled trades may need to be inside the safeguarded area and have control of the motion - consider an enable device or pendant.
4. Preventive maintenance - where practical, design safe access for the particular tasks that need to be done with power on.
5. Major repair/component replacement - follow the lockout and hazardous energy control procedure.



The passer-by is used to address an untrained person that walks up to the machine / equipment and **inadvertently accesses the hazardous area**.

1. The hazards associated with "inadvertent access" should include those hazards that the material handler, operator and set-up person are exposed to.
   - refer to all task-hazards above
2. Generally, the respective solutions normally will be ok since "inadvertent access" will be less frequent.
   - refer to all task-hazard solutions above
3. Further analysis is required to make sure that all hazards a passer-by is exposed to have been addressed with the current safeguarding solutions.

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Evaluate the safeguard selection for operator material handling, initiate cycle and manual motion (pb) tasks. Where hazards exist and a gate, door, light curtain or two-hand control are used to protect the operator, a fixed guard should protect all other sides of the machine.
(i.e. fixed guard on 3 sides, w/ light curtain).

A fixed guard would not be necessary if the hazard cannot be reached (i.e. no hazards are reachable from the back of the machine)