

DACUM VALIDATION CHART: Entry-Level Operator

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DACUM PANEL

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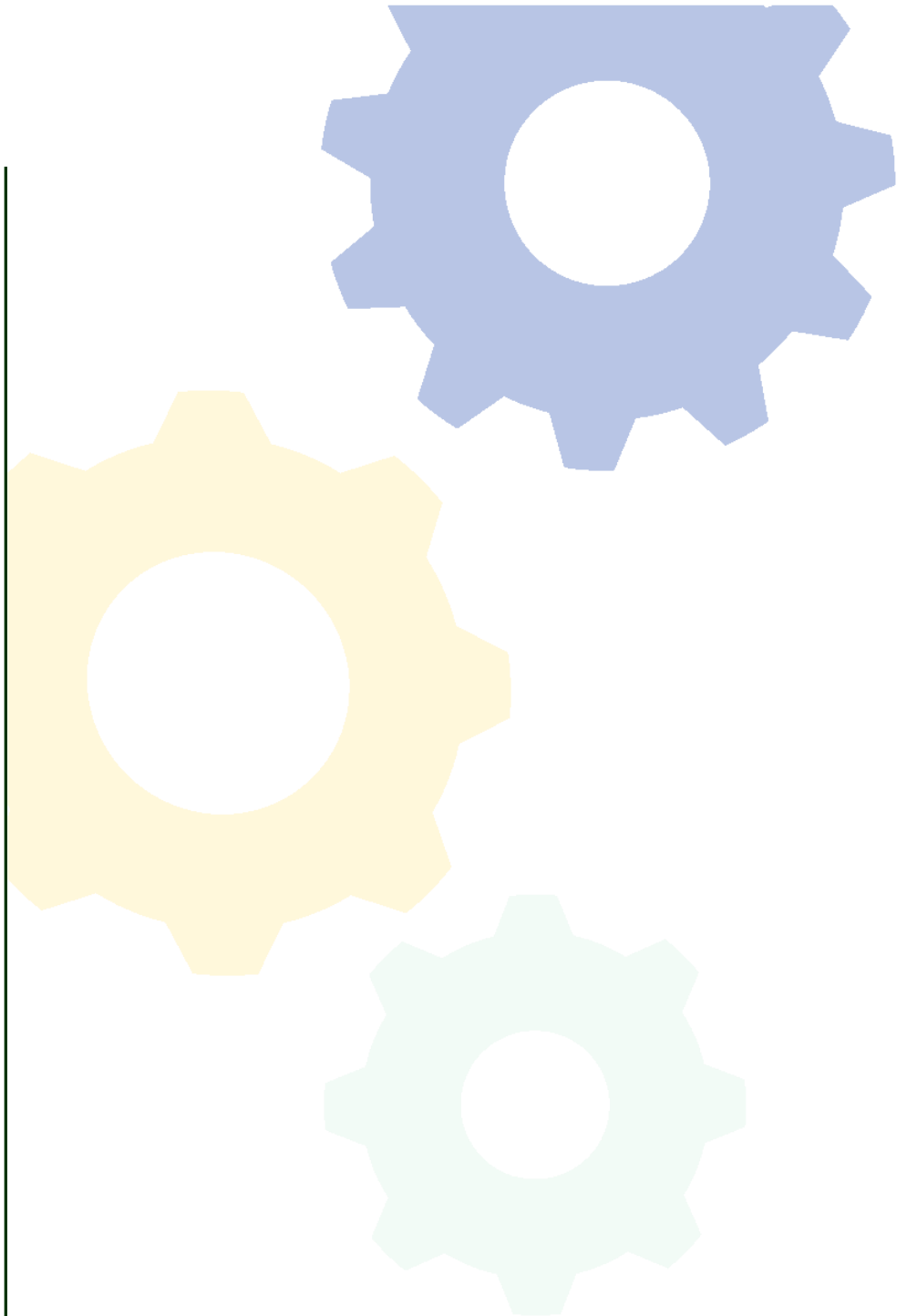
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DACUM Validation Chart for an “awesome” Entry Level Operator

Duties	Tasks →					
A Maintain Safe Work Environment	A1 Maintain a clean workstation 	A2 Clean machine before and after a job 	A3 Scrap waste material 	A4 Separate solids from chips 	A5 Dispose of hazardous waste properly 	A6 Inspect machine for basic safety issues
	A7 Provide process improvement feedback 					
B Inspect Parts Before, During, and After Production	B1 Perform in-process inspection 	B2 Ensure measuring equipment is calibrated and accurate 	B3 Perform visual inspections 	B4 Reject out of tolerance parts 	B5 Rework parts to specification (correct) 	B6 Check material stock and size according to specification
C Perform CNC Milling Operations	C1 Produce parts to specification using CNC Mill 	C2 Run production using CNC mill 	C3 Adjust part (offsets) dimension for CNC Mills 			
D Perform CNC Lathe Operations	D1 Produce parts to specification using CNC Lathe 	D2 Run production using CNC lathe 	D3 Check collet/guide bushing 	D4 Adjust part (offsets) dimension for lathes 		
E Maintain CNC Machines	E1 Maintain proper fluid levels 	E2 Change machine oil/coolant 	E3 Service coolant tank (clean mud, swart) 	E4 Assess coolant concentrations	E5 Maintain proper machine pressures 	E6 Replace worn tools/inserts as needed
	E7 Clean cooling fans	E8 Clean CNC machines (especially new guys) 	E9 Report machine failure 	E10 Clean machine filters (e.g., oil, coolant, air) 	E11 Replace machine filters (e.g., oil, coolant, air) 	E12 Grease zerk fittings
F Perform Secondary Operations	F1 Hand grind metal part 	F2 Chamfer sharp part 	F3 Debur rough-edged sharp part 	F4 Polish rough surface	F5 Ream drilled hole	F6 Bend part to job specification
	F7 Countersink drilled hole (drill press) 	F8 Tap drilled hole				
G Perform Manual Milling Operations	G1 Perform manual mill job setup 	G2 Perform dry run first part using manual mill	G3 Make part according to job specifications using manual mill	G4 Run production using manual mill		

Occupational Definition: An awesome Entry Level Operator relies on a team and a strong work ethic to efficiently convert raw materials into quality products by following standard operating procedures making parts to customer specifications thereby ensuring quality, efficiency, productivity and profitability for themselves, their team, their company and the manufacturing field.

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Duties

Tasks

Duties	Tasks					
H Perform Manual Lathe Operations	H1 Perform manual lathe job setup 2 3 1	H2 Perform dry run using manual lathe	H3 Make part according to job specifications using manual lathe	H4 Run production using manual lathe		
	I1 Record part count 1 1	I2 Move parts/product to next operation/inspection 1 2	I3 Complete job traveler 2 3 2 2			
J Perform Sawing Machine Operations (Bandsaw, chopsaw, cold saw)	J1 Perform saw job setup 1 1 1	J2 Saw material to job specifications	J3 Clean machine after use 2 1 1	J4 Return material to stock rack 1		
	K1 Finish parts to specification using grinder	K2 Run production using grinder	K3 Adjust part (offsets) dimension for grinders 2			
L Pursue More Learning	L1 Participate in job center training 1 1	L2 Ask questions of veteran employees 1 3				
	M1 Start/warm up machine 1 1	M2 Prepare for shift handoff 1 3				
M Perform Pre/Post Shift Tasks	N1 Remove excess stock 1	N2 Remove cutting tools 1	N3 Clean machine interior 1	N4 Remove material chips 1	N5 Return tools and holders to designated location 1 2	

Legend

-Critical Task
- Training Most Needed by New Workers
- Training Most Needed by Veteran Workers
-Time Spent on Task

Note: Numbers represent total votes from 7 of the 8 panelists.

Occupational Profile: Entry-level Operator

Knowledge & Skills

- 3D Visualization
 - ◇ Orthographic projection
- Basic Programming, G-codes, M-codes (read ahead) - nice to have
- Blue Print Reading
 - ◇ Specs of parts
- Communication skills
 - ◇ Good listening skills
 - * Bangs/crashes
 - * Comp. verbal inst.
 - * New tool
 - ◇ Verbal and non-verbal
 - * Read body language, do not display aggressive body language
 - ◇ Coordinate with job designer regarding job
- Computer Skills
 - ◇ Time clock
 - ◇ Windows file structure
 - ◇ MS Word- write up/documentation, use spell check, ignore grammar check (nice to have, not essential, but need to be able to read)
 - ◇ MS Excel- use spreadsheets (need to be able to read, not manipulate)
 - ◇ CAD/CAM (knowledge of what it is) - nice to know
- Grammar/Spelling Skills
 - ◇ Spell check
- Keyboarding skills (Hunt and peck)
- Know when to act within scope of duties
- Know where E-stop button is located (safety)
- Lean manufacturing principals
- Math
 - ◇ Basic shop math
 - * Add/Subtract (counting skill is lacking)
 - * Multiply/Divide
 - * Fractions and Decimals Conversion
 - * Standard/ metric conversion
 - ◇ Units of Measure
 - ◇ Geometry - Know your shapes and how to measure them :
 - * Lines & Angles
- * Triangles
- * Circles
- * Polygons
- ◇ Algebra: Solve plug and play equations
- ◇ Trig: Basic knowledge of the following to check parts/inspection
 - * Pythagorean Theorem
 - * Sin, Cos, Tan
- Mechanical skills - helpful
- Metals
 - ◇ Metal Manufacturing
 - ◇ Physical Properties of Metals
 - ◇ Machine Properties of Metals
 - ◇ Metal Classification
 - ◇ Non Ferrous Metals
 - ◇ Ferrous Metals and Alloys
 - ◇ Heat Treatment of Steel
 - ◇ Metal Removal Processes
- Organizational skills
 - ◇ Keep a clean and well organized work area/bench
 - ◇ Tools
 - ◇ Job order
- Problem solving skills
 - ◇ Troubleshoot issues with parts
- Quality control—use of precision measuring instruments
 - ◇ Basic Measurements (e.g., dial calipers, micrometers, thread go and no-go gauges)
 - ◇ Surface Measurement
 - ◇ Calipers
 - ◇ Gages
 - ◇ Geometric dimensioning and tolerancing (GD&T) - basic knowledge so you can inspect g or t
- Recognize signs of where and when to change tool
- Reading skills
 - ◇ Blueprints-difficult for many
 - ◇ Job travelers
 - ◇ SDS sheets
 - ◇ Operator manuals
 - ◇ Read and document control plans/instructions
- ◇ Set-up sheets
- ◇ Computer display information
- ◇ Notes from previous shift
- ◇ Walk-through procedures
- Safety knowledge
 - ◇ OSHA
 - ◇ Hazardous Waste Handling
 - ◇ Machine Guarding
 - ◇ Lockout/ Tag Out
 - ◇ Lifting
 - ◇ Hand and Power Tool Safety
 - ◇ Fire Safety & Prevention
 - ◇ Flammable/ Combustible Liquids
 - ◇ (M)SDS & Hazard Communication
 - ◇ Metalworking Fluid Safety
 - ◇ Safety for Metal Cutting
 - ◇ Noise Reduction/Hearing Conversation
 - ◇ Shop terminology, i.e.
 - * Lingo for measurements, secondary functions ex. “Lap a part”, “chase a thread”, “move a tool in a thou”, etc.
 - ◇ User maintenance manual per machine
- SPC
- Speeds and feeds
- Time management skills
 - ◇ Maintain efficient production schedule
 - ◇ Use time wisely
 - ◇ Prioritize tasks
 - ◇ Polish parts
 - ◇ Don't waste time
 - ◇ Return from breaks/lunch on time
- Use tools competently
- Writing skills
 - ◇ Legible
 - ◇ Write documentation to be understood (notes, phrases)
 - ◇ Communicate succinctly
 - ◇ Write detailed notes on what happened during shift
 - ◇ Document part rejection tags
 - ◇ Write numbers with accurate decimals
 - ◇ Document walk-through procedures

Traits & Behaviors

- Ability to listen and retain information and apply later
- Accountable
- Accurate
- Analytical/logical
- Confident
- Continuous improvement
- Cooperative
- Creative (helpful-good for problem solving)
- Dependable
- Detail-oriented
- Diligent
- Efficient
- Engaged
- Enthusiastic
- Ethical
- Focused
- Functions under pressure
- Humble
⇒ "If you have ego, you need to go home"
- Inquisitive
- Learner (not necessarily quick, but must be willing and able to learn)
- Mechanically inclined
- Observant
- Patient
- Positive attitude
◇ "Can do it" attitude
◇ "Hit the ground running kind of attitude"
- Professional
- Punctual
◇ Attendance
◇ Start & stop times
- Reliable
- Respectful (of everybody, respect other's work and work area)
- Responsible
- Self-motivated
- Self-starter
- Sense of urgency
- Stress tolerant (helpful)
- Takes pride in work
- Team Player (team spirit)
- Thick-skinned (at some businesses-absolutely!)
- Willing to participate

Tools & Equipment

- 1-2-3 blocks *
- Adjustable parallels *
- Allen Wrench
- Belt grinder
- Boring machining *
- Bridgeport (Manual mill)
- Calipers
- Chucks
- Clamps
- Cleaning equipment (including sandblasters)
- Comparator (Surface-provide own)
- Compasses *
- Cooling plate
- Cranes: overhead and chain fall
- Cutting tools
◇ Indexable cutting tools
◇ End mills
◇ Reamers
- Cylindrical grinder **
- Dead blow hammer
- Degreaser
- Depth Gauge
- Depth micrometer
- Dial indicator
- Drill bits *
- Drill press *
- Drop indicator *
- Edge finder
- Engine lathe *
- Eye-loupe
- Feeler Gauges
- Files
- Fork lift
- Gage pin
- Grinding tools (e.g., blocking body)
- Grinding/polishing spindle
- Hand tools common (e.g., screw driver)
- Hardware/arbor press
- Height gage (not food-for heating parts)
- Magnetic base
- Material Handling equipment
- Measuring tools
◇ Band saw *
- Micrometer (1/10,000 or 1/1000)
- Microscope 30 X (shop provided)
- Mirror
- Miter saw
- Optical comparator (Shop provided)
- Palletizers
- Parallels *
- Pedestal grinder
- Precision gage blocks
- Press brake *
- Production monitoring equipment
- Profilometer (type of comparator-shop provided) *
- Protractor
- Punch press *
- Radius gages
- Rods (used with springs)
- Saw
◇ Wet saw
- Scale
- Scientific calculator
- Scribes *
- Sine plate *
- Software
◇ CAD/CAM
◇ MS Word, Excel
- Square
- Stones
- Surface grinder
- Surface plate (shop provided)
- Test indicator
- Thread gage
- Tool box (some still bring own tools)
- Tool pre-setter (shop provided)
- Torque wrenches (shop provided)
- Torx bits *
- V block *
- Washer

Note: Tools or equipment with an asterisk (*) indicate tools not used by all operators, and not used in Spring Manufacturing.

Workplace Needs & Expectations

- Come ready for work
- Utilize proper PPE
- Workers are expected to stay at their assigned work area and focus on the "job at hand"; not wander around and waste time talking and distracting work associates.
- Phone use should be limited to emergency calls only
- No digital music players/ear jacks/ headphones allowed in a manufacturing setting. (some have a one-ear rule)
- Workers are expected to know their job description and understand their duties (when available)
- Workers who are more eager to learn (proactive) will be more successful
- Communicate early and often about work or failures
- Expected to work way up
- "Can't make a good machinist out of a programmer, can make a good programmer out of a machinist."
- Need to know manual machining before you can move to CNC
- Expected to maintain tools
- Expected to keep machine and area clean during run process (but not inside machine while running)
- Keep production going—make ready for the next shift, "should look like it did when you started."
- Check your parts before you send them on to the next step, "perform your checks not just to be sure they are accurate, but also to protect yourself."
- Expected to stay until job is done, in spite of when shift ends (for some)
- Need to be able to keep up with changes in technology
- Know to stay away from dangerous hazards
- Voice all concerns
- Be productive during down time—use the time for learning more. "When you have nothing else to do...sweep", "Money is time"

Physical Attributes

In order to perform the necessary functions of the job, the worker must be able to:

- Stand for minimum of 8 hrs (with breaks and lunch)
- Lift 35-50 lbs. without help
- Wheelchair bound - it would be physically difficult to perform the duties of the position from a wheelchair, would need modifications
- Color Blind - Not an issue unless the position includes electrical work. Need to be able to differentiate colors of wires.
- Deaf - potential safety issue, but not necessarily an impediment to performing the work. Need to be able to detect the machine for when it is not running as it should and prevent problems. Depending the company, accommodations can be made (flashing lights for fire alarms, safety devices, etc)
- Blind - deal breaker. Cannot perform the duties of the position without the ability to see.
- Missing limb - Depends on the limb, arm could be a problem, accommodations could be provided
- Hand mobility - Essential to perform the duties of the position.
- Hand sensitivity - Potential safety issue, without the ability to detect rough or hot surfaces, you could easily be cut or burned.
- Dexterity - Essential to perform the duties of the position.

Appearance

- Personal hygiene-"don't hide it with perfume/cologne"
- Adhere to dress code
 - ◊ No baggy/loose or torn clothing
 - ◊ No loose jewelry
 - ◊ Proper PPE (Steel toe for some), safety glasses (always), ear plugs
 - ◊ No nylon—safety issue
- No facial hair- for some (if wearing a respirator, or welders)
- Hair up, if long.
- No shorts (for some)
- Close toed shoes
- Presentable appearance

Attendance/Work Shifts

- Be there, and one time
- Show up everyday
- Stay until shift is done, return from breaks on-time
- Expected to be highly flexible and available for overtime- no whining
- Prepare in advance for snow (find reasons to come, not excuses for why not)
- Show up before scheduled time (10-15 min) (for some companies)

Certifications/Licensure

Mandatory:

- N/A
- Valid ID
- High School/Equivalency
- 18 years old
- DD 214 (if military)
- College credentials not necessary - "This job is open to those who just want to work"

Helpful/Useful:

- Forklift
- First Aid/CPR
- NYS Apprenticeship
- OSHA 10
- GD&T Blueprint Reading

Machines Used

- Arbor Press
- **Band Saws (3)**
- Belt Sander (wet & dry)
- **Bench Grinder (1)**
- CNC Bending
- Dot Peen Machine
- **Drill Press (1)**
- **Grinder (1)**
- **Horizontal Mill (5)**
- Laser
- **Lathe (CNC) (6)**
- **Manual Mill/Lathe (1)**
- Pem Setter
- Pin Stamper
- Press Brake
- Rivet Press
- Sand Blaster
- Sheer
- Sheet Metal Press
- Spot Welder
- **Spring Coiler (mechanical & CNC) (2)**
- **Tool Sharpeners (2)**
- Tumbler/Shop Blaster
- **Vertical Mill (8)**
- Water Jet
- Wire EDM

* *Bolded items indicate core suggestions for Entry-level Operator with number of panelist votes in parenthesis.*

Future Trends & Concerns

- There is a stigma surrounding manufacturing jobs and people don't understand the reality of the work or opportunity. People need to understand that college isn't for everybody—there are other viable pathways in manufacturing
- Employers who offer apprenticeships are finding their employees do not want to pursue additional training required (in spite of incentives). Workers believe this may be due to incentives being mismatched or minimal, i.e., asking for considerably more time for very little compensation.
- Pervading sense of entitlement amongst current candidate pool, especially younger workers and union workers. (some businesses)
- Soft skills are lacking
 - ◊ Difficult to find good soft skills in new workers (some)
 - ◊ Lack of soft skills prevents ability for workers to advance to leadership roles (some)
 - ◊ Workers who come with soft skills could be hired as a leader (less experience required) (some)
 - ◊ “Promote to highest level of incompetence” - some with less experience can be promoted vs. those with more if soft skill allow (some)
- Struggle to find committed people (some employers)
- Employers like to see/start manual machine operator prior to moving to CNC
- Manufacturing is trending towards more automation and is becoming more high speed/high tech
- Benefits are being provided competitively—tuition reimbursements/retirement plans (some) starting
- Workers concerned about cost of benefits
- Manufacturing decline (up and down) and how it impacts job stability
- Competition with China and how it may impact the future for manufacturing
- Workers feel like compensation should be based on merit
- Stereotype about who will be successful in manufacturing
- Future generations don't even know about it (manufacturing as a career)

As new Operators, the panelists felt unprepared for:

- Using measuring tools/equipment (calipers, micrometers, programming electric equipment) *
- Lack of tools and personal gages and tool box
- Lack of experience on new work centers
- Lack of machining certain materials
- Running the machine*
- Not knowing what to expect of this big machine
- Thought they had to know everything about the machines and how to do everything by themselves
- Not knowing the equipment that they were going to be working with
- Making changes on the machines
- How to tell when the machine was running and stopped.
- How to make off sets
- Changing inserts
- Changes in technology when running CNC; those with previous manufacturing experience coming back to the field needed to relearn
- Knowing the appropriate attire (company specific, but long-sleeved shirts get dirty when working with many types of machines)

* Items marked with an asterisk (*) were mentioned numerous times

Acronyms Used

CAD: Computer Aided Design
CAM: Computer Aided Machinery
CDC: Center for Disease Control and Prevention
CMM: Computerized Maintenance Management Systems
CNC: Computer Numerical Control
DOT: Department of Transportation
EPA: United States Environmental Protection Agency
FAA: Federal Aviation Administration
FDA: United States Food and Drug Administration
GLP: Good Laboratory Practice
GMP: Good Manufacturing Practice
ISO: International Organization for Standardization
MS: Microsoft
MSDS: Material Safety Datasheet
NFPA: National Fire protection Agency
OSHA: Occupational Safety & Health Administration
PLC: Programmable Logic Controllers
PPE: Personal Protective Equipment
SOP: Standard Operating Procedure
SPC: Statistical Process Control
USDA: United States Department of Agriculture

Mismatch in Employment Expectation

As new operators on the job, the panelists were initially disillusioned by the following:

- Expected a more hostile work environment—surprised that everyone was really friendly and the shop floor was well lit and clean
- Thought there would be more formal training; to be trained by the machine tool manufacturer
- Expected more supervision
- Expected a very rapid movement up in levels of promotions in a short period of time. Thought that doing one task one time qualified them for promotion (it did not).

Manufacturing as a Career/Reporting Structure

Manufacturing is an environment where many people with differing levels of education and experience can find a sustainable career. As one of our panelists said, “this job is open to those who just want to work”. A sense of pride not only for their work but for their individual companies and teams was evident. We “do this for the team”, said several of the panelists and almost all came wearing company attire, “we wear these shirts—we come in unified, for the team”

Obtaining certifications (such as specific machine certifications) on the job was a goal for some of the panelists, national certifications such as CPT and NIMS were not recognized by the panelists. While women are still the minority, the gap is lessening. When asked for recommendations of ideal workers, two of our employer partners recommended women from their team.

As Operators are typically entry-level positions, many do not have any direct reports. However, some Operators can sometimes supervise other lower level Operators. Depending on their skill level and the company, operators may report to a higher-level operator, a setup tech, or a lead operator/tech. The reporting structure typically flows as follows:

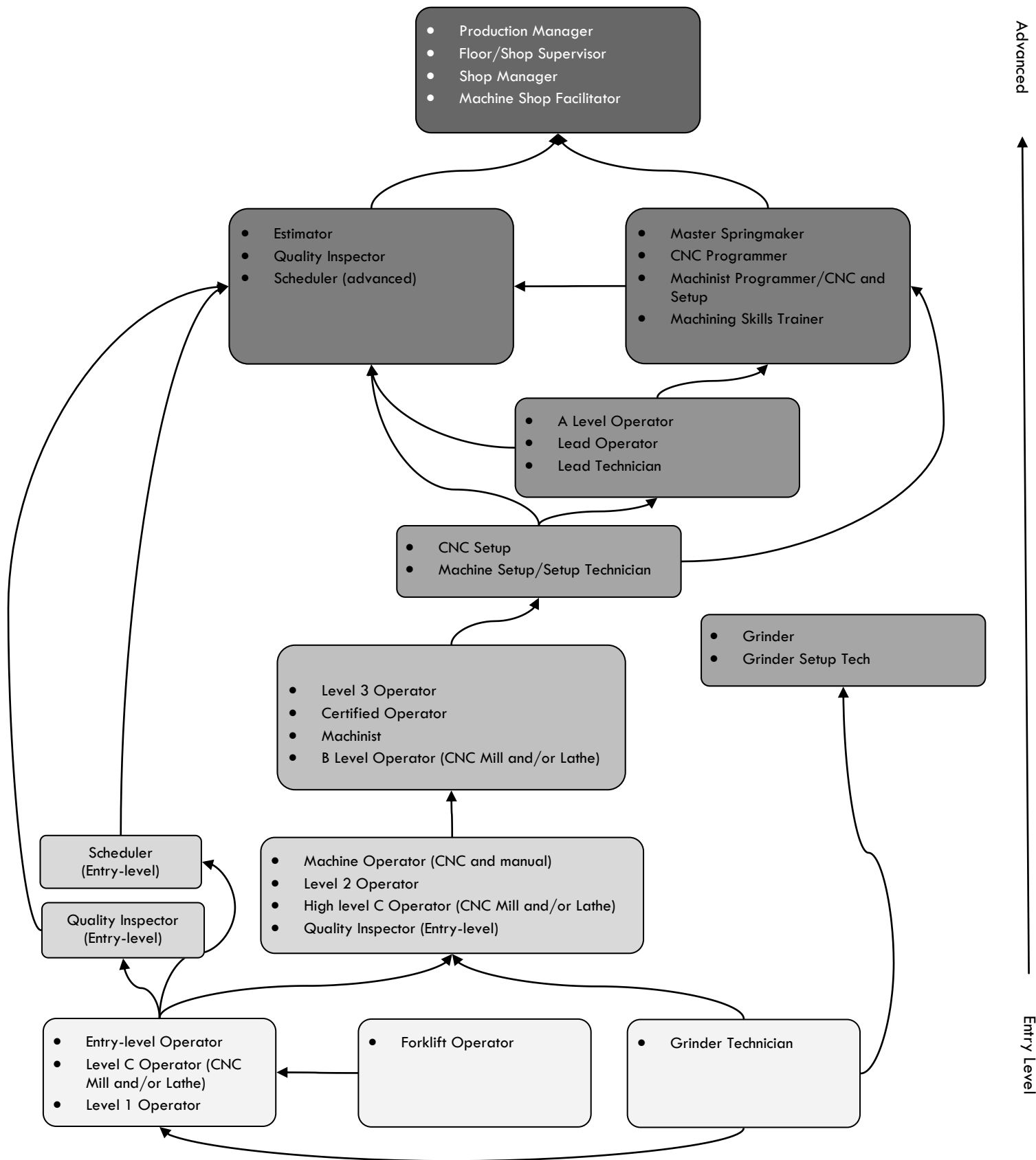
Operator —> Advanced-Level Operator or Setup Tech —> Lead Operator/Tech —> Production Manager or Floor/Shop Supervisor or Machine Shop Facilitator —> Plant Manager —> Owner/President

Operators often work with the following key individuals:

- CNC mill operators
- Grinder set up tech/operator
- Lead Operator/Tech - each machining area (discipline) has a lead
- Machine operators
- Machine setup persons/set technicians
- Maintenance personnel
- Manufacturing engineers
- Material handler (also called the “wire guy”)
- Owner/president
- Purchasing agent
- Q.A. personnel
- Quality control
- Quality inspector
- Quality manager
- Sheet metal workers
- Shipping and receiving personnel
- Supplies material and inventory manager
- Tool crib attendant
- Welders

For a pathway of progression within the job as described by the panelists, please see the “Potential Job Path for Operators” graph on the following page.

Potential Job Path for Operators



Please note: It is not necessary for a person to move through each of these phases of advancement to reach a particular position level. Companies differ on which titles are utilized for which rank of position. The titles and levels indicated are a measure of jobs typically performed from entry level (little to no experience and/or training) to more advanced skill level.

Onondaga Community College wishes to extend a special “thank you” to the following businesses for sponsoring their worker(s) for a one-day workshop in order to develop this occupational profile for Operators, and to all of the expert workers who served on the DACUM panel. Our program will be better because of your direction and guidance.



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