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SHAPING POSSIBILITY®

Ergonomic Risk Reduction: Hypertherm's Data-Driven Approach

Dave Kiser, EHS Manager

PLASMA | LASER | WATERJET | AUTOMATION | SOFTWARE | CONSUMABLES

Introduction to Hypertherm

- World leader in plasma and waterjet cutting technology
- Also manufacture laser cutting consumables, PC Boards, CNC controllers, wiring harnesses, and 3D cutting software.
- 16 production facilities
  - 10 facilities in New Hampshire (plasma)
  - 4 facilities in Washington (waterjet)
  - 1 facility in Minnesota (waterjet)
  - 1 facility in Italy (consumables)
  - Many sales and demonstration labs around the world
- Over 2,000 associates worldwide

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Water Jet

Heavy Industrial / Mechanized Systems

Laser

Light Industrial / Manual Systems

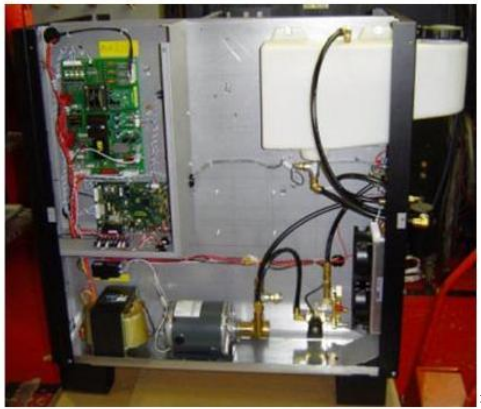
Customers Include:

- Artwork, signs, ornamentation
- Automotive
- Construction
- Energy
- Farming & ranching
- Maintenance and repair
- Manufacturing
- Mechanical Contractors
- Metal Fabrication
- Mining
- Pipes and pipelines
- Shipbuilding
- Transportation
- Steel Service / Scrap
- Demolition
- Training & Education



Manufacturing Operations Include…

- CNC machine shops
- Assembly production
- R&D labs
- Electrical Testing
- Customer Training Labs



What are *ergonomic injuries*?

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What are *ergonomic injuries*?

Musculoskeletal disorders (MSD) are injuries or disorders of the muscles, nerves, tendons, joints, cartilage, and spinal discs. Work-related musculoskeletal disorders (WMSD) are conditions in which:

1. The work environment and performance of work contribute significantly to the condition; and/or
2. The condition is made worse or persists longer due to work conditions

Risk of MSDs are present in nearly every industry: Agriculture, Construction, Healthcare, Manufacturing, Mining, Transportation, Wholesale and Retail Trade.

- Examples of work conditions that may lead to WMSD include routine lifting of heavy objects, daily exposure to vibration, routine overhead work, working with the neck in chronic flexion position, or performing repetitive forceful tasks. Main risk factors include *Force, Posture and Repetition*.

- Examples of MSDs include:
  - Sprains, strains, and tears
  - Back pain
  - Carpal tunnel syndrome
  - Lateral epicondylitis (tennis elbow)
  - Hernia

Work-Related Musculoskeletal Disorders & Ergonomics | Workplace Health Strategies by Condition | Workplace Health Promotion | CDC

What is the impact?

- Musculoskeletal disorders are associated with high costs to employers such as absenteeism, lost productivity, and increased health care, disability, and worker's compensation costs. MSD cases are *more severe* than the average nonfatal injury or illness.

- In 2001, MSDs involved an average of 8 days away from work compared with 6 days for all nonfatal injury and illness cases (e.g., hearing loss, occupational skin diseases such as dermatitis, lacerations, burns, etc.)
  - Machine operators, fabricators, and laborers; and persons in technical, sales, and administrative support occupations accounted for 58% of the MSD cases[3]
  - The manufacturing and services industry sectors together accounted for about half of all MSD cases.

- Musculoskeletal disorders account for nearly 70 million physician office visits in the United States annually, and an estimated 130 million total health care encounters including outpatient, hospital, and emergency room visits[3]

Work-Related Musculoskeletal Disorders & Ergonomics | Workplace Health Strategies by Condition | Workplace Health Promotion | CDC

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What is the impact?

- In 1999, nearly 1 million people took time away from work to treat and recover from work-related musculoskeletal pain or impairment of function in the low back or upper extremities

- According to Liberty Mutual, the largest workers' compensation insurance provider in the United States, overexertion injuries—lifting, pushing, pulling, holding, carrying or throwing an object—cost employers $13.4 billion every year[3]

- The Institute in Medicine estimates the economic burden of WMSDs as measured by compensation costs, lost wages, and lost productivity, are between $45 and $54 billion annually[3]

Work-Related Musculoskeletal Disorders & Ergonomics | Workplace Health Strategies by Condition | Workplace Health Promotion | CDC

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Hypertherm’s experience with Ergonomics…

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Ergonomics at Hypertherm

At Hypertherm, ergonomic hazards are present in most production operations:

- Small parts assembly (fine motor)
- Heavy & large parts assembly (lifting and maneuvering parts)
- Cable and harness assembly (pushing/pulling)
- Warehouse operations (pinch grip and lifting)
- Secondary assembly (packaging and labeling).
- Use of manual hand tools throughout operations.

- More than 53% of all Hypertherm injuries are ergonomic-related.

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Hypertherm's past efforts…

- As Hypertherm's business grew rapidly in the mid-2000s, ergonomic injuries began to rise. Customer orders far exceeded our production capacities and automation was not yet widely implemented.
  - At the time, traditional risk assessment methodology did not effectively identify ergonomic hazards.
- To combat the rise in ergo injuries, Hypertherm partnered with a local physical therapy and wellness provider.
  - A local Physical Therapist was hired to work on-site part time (10 hrs. per week).
    - Develop specific stretching exercise routines for production cells;
    - Meet with associates who report early signs & symptoms;
    - Consult with Team Leaders and Engineers on workstation improvements;
    - Involved with production cell and tooling design;
    - Assisted in developing job-rotation schedules.

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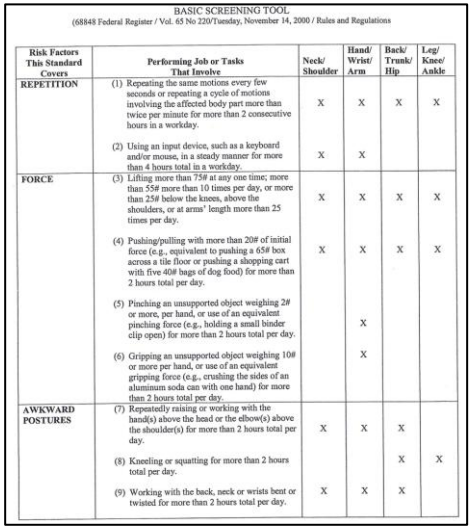
Hypertherm's past efforts…

- The on-site therapist used traditional ergo-evaluation tools and methodology and communicated recommendations to Team Leaders and Engineers:

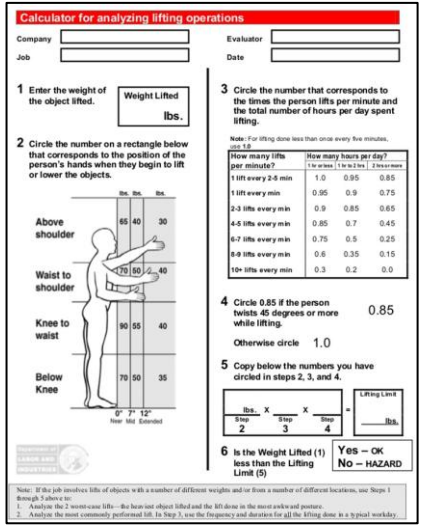


BASIC SCREENING TOOL

(68848 Federal Register / Vol. 65 No 220/Tuesday, November 14, 2000 / Rules and Regulations

Risk Factors This Standard Covers	Performing Job or Tasks That Involve	Neck/ Shoulder	Hand/ Wrist/ Arm	Back/ Trunk/ Hip	Leg/ Knee/ Ankle
REPETITION	(1) Repeating the same motions every few seconds or repeating a cycle of motions involving the affected body part more than twice per minute for more than 2 consecutive hours in a workday.	X	X	X	X
	(2) Using an input device, such as a keyboard and/or mouse, in a steady manner for more than 4 hours total in a workday.	X	X		
FORCE	(3) Lifting more than 75# at any one time; more than 55# more than 10 times per day, or more than 25# below the knees, above the shoulders, or at arms' length more than 25 times per day.	X	X	X	X
	(4) Pushing/pulling with more than 20# of initial force (e.g., equivalent to pushing a 65# box across a tile floor or pushing a shopping cart with five 40# bags of dog food) for more than 2 hours total per day.	X	X	X	X
	(5) Pinching an unsupported object weighing 2# or more, per hand, or use of an equivalent pinching force (e.g., holding a small binder clip open) for more than 2 hours total per day.		X		
	(6) Gripping an unsupported object weighing 10# or more per hand, or use of an equivalent gripping force (e.g., crushing the sides of an aluminum soda can with one hand) for more than 2 hours total per day.		X		
AWKWARD POSTURES	(7) Repeatedly raising or working with the hand(s) above the head or the elbow(s) above the shoulder(s) for more than 2 hours total per day.	X	X	X	
	(8) Kneeling or squatting for more than 2 hours total per day.			X	X
	(9) Working with the back, neck or wrists bent or twisted for more than 2 hours total per day.	X	X	X	

Basic risk factor screening tools



Calculator for analyzing lifting operations

Company

Job

Evaluator

Date

1 Enter the weight of the object lifted. Weight Lifted lbs.

2 Circle the number on a rectangle below that corresponds to the position of the person's hands when they begin to lift or lower the objects.

Above shoulder 65 40 30

Waist to shoulder 70 50 40

Knee to waist 90 55 40

Below Knee 70 50 35

0° 7° 12°

Near Mid Extended

3 Circle the number that corresponds to the times the person lifts per minute and the total number of hours per day spent lifting.

Note: For lifting done less than once every five minutes, use 1.0

How many lifts per minute?	How many hours per day? 1 hr or less	1 hr to 2 hrs	2 hrs or more
1 lift every 2-5 min	1.0	0.95	0.85
1 lift every min	0.95	0.9	0.75
2-3 lifts every min	0.9	0.85	0.65
4-5 lifts every min	0.85	0.7	0.45
6-7 lifts every min	0.75	0.5	0.25
8-9 lifts every min	0.6	0.35	0.15
10+ lifts every min	0.3	0.2	0.0

4 Circle 0.85 if the person twists 45 degrees or more while lifting. 0.85

Otherwise circle 1.0

5 Copy below the numbers you have circled in steps 2, 3, and 4.

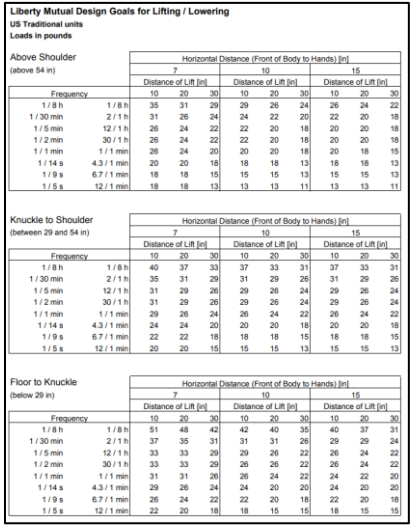
lbs. x Step 2 x Step 3 x Step 4 = Lifting Limit lbs.

6 Is the Weight Lifted (1) less than the Lifting Limit (5) Yes – OK No – HAZARD

Note: If the job involves lifts of objects with a number of different weights and/or from a number of different locations, use Steps 1 through 5 above to:

1. Analyze the 2 worst-case lifts—the heaviest object lifted and the lift done in the most awkward posture.
2. Analyze the most commonly performed lift. In Step 3, use the frequency and duration for all the lifting done in a typical workday.

NIOSH lifting calculator



Liberty Mutual Design Goals for Lifting / Lowering

US Traditional units

Loads in pounds

Above Shoulder (above 54 in)

Frequency	Horizontal Distance (Front of Body to Hands) [in]	7			10			15		
		Distance of Lift [in]			Distance of Lift [in]			Distance of Lift [in]		
		10	20	30	10	20	30	10	20	30
1 / 8 h	1 / 8 h	35	31	29	29	26	24	26	24	22
1 / 30 min	2 / 1 h	31	26	24	24	22	20	22	20	18
1 / 5 min	12 / 1 h	26	24	22	22	20	18	20	20	18
1 / 2 min	30 / 1 h	26	24	22	22	20	18	20	20	18
1 / 1 min	1 / 1 min	26	24	20	20	20	18	20	18	15
1 / 14 s	4.3 / 1 min	20	20	18	18	18	13	18	18	13
1 / 9 s	6.7 / 1 min	18	18	15	15	15	13	15	15	13
1 / 5 s	12 / 1 min	18	18	13	13	13	11	13	13	11

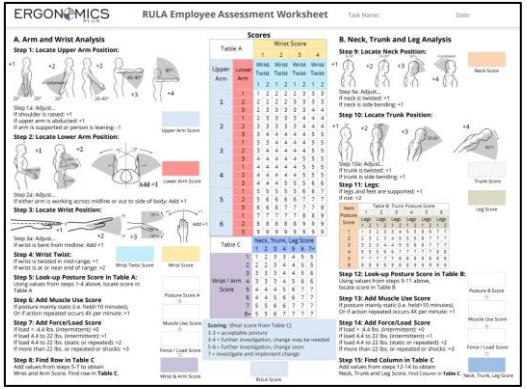
Knuckle to Shoulder (between 29 and 54 in)

Frequency	Horizontal Distance (Front of Body to Hands) [in]	7			10			15		
		Distance of Lift [in]			Distance of Lift [in]			Distance of Lift [in]		
		10	20	30	10	20	30	10	20	30
1 / 8 h	1 / 8 h	40	37	33	37	33	31	37	33	31
1 / 30 min	2 / 1 h	35	31	29	31	29	26	31	29	26
1 / 5 min	12 / 1 h	31	29	26	29	26	24	29	26	24
1 / 2 min	30 / 1 h	31	29	26	29	26	24	29	26	24
1 / 1 min	1 / 1 min	29	26	24	26	24	22	26	24	22
1 / 14 s	4.3 / 1 min	24	24	20	20	20	18	20	20	18
1 / 9 s	6.7 / 1 min	22	22	18	18	18	15	18	18	15
1 / 5 s	12 / 1 min	20	20	15	15	15	13	15	15	13

Floor to Knuckle (below 29 in)

Frequency	Horizontal Distance (Front of Body to Hands) [in]	7			10			15		
		Distance of Lift [in]			Distance of Lift [in]			Distance of Lift [in]		
		10	20	30	10	20	30	10	20	30
1 / 8 h	1 / 8 h	51	48	42	42	40	35	40	37	31
1 / 30 min	2 / 1 h	37	35	31	31	31	26	29	29	24
1 / 5 min	12 / 1 h	33	33	29	29	26	22	26	24	22
1 / 2 min	30 / 1 h	33	33	29	26	26	22	26	24	22
1 / 1 min	1 / 1 min	31	31	26	26	24	22	24	22	20
1 / 14 s	4.3 / 1 min	29	26	24	24	20	20	24	20	20
1 / 9 s	6.7 / 1 min	26	24	22	22	20	18	22	20	18
1 / 5 s	12 / 1 min	22	20	18	18	15	15	18	15	15

Design Goals for Lifting / Lowering



ERGONOMICS RULA Employee Assessment Worksheet

Task Name: Date:

A. Arm and Wrist Analysis

Step 1: Locate Upper Arm Position:

Step 1a: Adjust...

If shoulder is raised: +1

If upper arm is abducted: +1

If arm is supported or person is leaning: -1

Step 2: Locate Lower Arm Position:

Step 2a: Adjust...

If either arm is working across midline or out to side of body: Add +1

Step 3: Locate Wrist Position:

Step 3a: Adjust...

If wrist is bent from midline: Add +1

Step 4: Wrist Twist:

If wrist is twisted in mid-range: +1

If wrist is at or near end of range: +2

Step 5: Look-up Posture Score in Table A:

Using values from steps 1-4 above, locate score in Table A

Step 6: Add Muscle Use Score

If posture mainly static (i.e. held>10 minutes), Or if action repeated occurs 4X per minute: +1

Step 7: Add Force/Load Score

If load < 4.4 lbs. (intermittent): +0

If load 4.4 to 22 lbs. (intermittent) or load 4.4 to 22 lbs. (static or repeated): +2

If more than 22 lbs. or repeated or shocks: +3

Step 8: Find Row in Table C

Add values from steps 5-7 to obtain Wrist and Arm Score. Find row in Table C.

Scores

Table A

Wrist Score

Upper Arm / Lower Arm

Table C

Wrist / Arm Score

Scoring: (final score from Table C)

1-2 = acceptable posture

3-4 = further investigation, change may be needed

5-6 = further investigation, change soon

7+ investigate and implement change

B. Neck, Trunk and Leg Analysis

Step 9: Locate Neck Position:

Step 9a: Adjust...

If neck is twisted: +1

If neck is side bending: +1

Step 10: Locate Trunk Position:

Step 10a: Adjust...

If trunk is twisted: +1

If trunk is side bending: +1

Step 11: Legs:

If legs and feet are supported: +1

If not: +2

Table B Trunk Posture Score

Neck, Trunk, Leg Score

Step 12: Look-up Posture Score in Table B:

Using values from steps 9-11 above, locate score in Table B

Step 13: Add Muscle Use Score

If posture mainly static (i.e. held>10 minutes), Or if action repeated occurs 4X per minute: +1

Step 14: Add Force/Load Score

If load < 4.4 lbs. (intermittent): +0

If load 4.4 to 22 lbs. (intermittent) +1

If load 4.4 to 22 lbs. (static or repeated): +2

If more than 22 lbs. or repeated or shocks: +3

Step 15: Find Column in Table C

Add values from steps 12-14 to obtain Neck, Trunk and Legs Score. Find Column in Table C.

Posture B Score

Muscle Use Score

Force / Load Score

Neck, Trunk, Leg Score

RULA Score

Worksheets for:
REBA (rapid entire body assessment)
RULA (rapid upper limb assessment)

- **However, ergonomic injuries persisted…**

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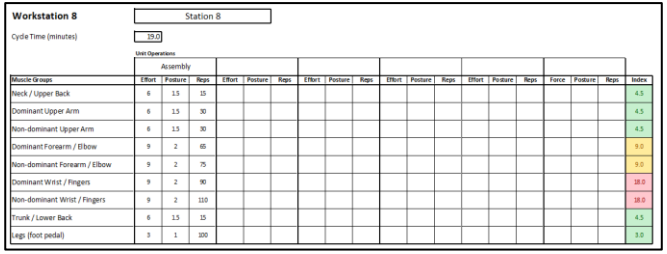
Hypertherm's past efforts… (Job Rotation Evaluator)

- In 2018, Hypertherm began looking for a system to better evaluate and manage it's ergo-risk data.
- Ergo hazards were known to exist, but there was no clarity on relative risk and how to prioritize improvement actions. In addition, job rotations were based on observations and were not data-driven.
- A new software tool was tried to better understand where the ergo-risks and rank them relative to severity. This was intended to generate better, more specific, ergo-hazard data and to set up job rotations accordingly.
- However, ergo injuries continued to persist…

Job Task – Risk Assessment Multipliers

Job Rotation Evaluator	Used to determine Exertion Index (EI) for each muscle group		
Factor / Variable	Rating Description	Rating Criterion	Multiplier
Exertion Effort	Very Light Light Moderate Hard Near Maximal	Relaxed Effort (barely noticeable) Noticeable Effort (definite effort) Obvious Effort (unchanged expression) Substantial Effort (changed expression) Maximal Effort (changed body mechanics)	1 3 6 9 13
Exertion Posture	Good Fair Poor Very Poor	Near Neutral Slight Deviation Marked Deviation Extreme Deviation	1.0 1.0 1.5 2.0
Exertions / Minute	Very Low Low Moderate High Very High	Less than 4 / minute 4 – 8 / minute 9 – 14 / minute 15 – 19 / minute More than 20 / minute	0.5 1.0 1.5 2.0 3.0
EXERTION INDEX (EI)	Low Moderate High	< 6.0 = Green 6.0 – 13.0 = Yellow > 13.0 = Red	

- Less than 6.0 = low risk (green)
- 6.0 – 13.0 = moderate risk (yellow)
- Greater than 13.0 = high risk (red)



Workstation 8 — Station 8

Cycle Time (minutes): 19.0

Unit Operations: Assembly

Muscle Groups	Effort	Posture	Reps	Effort	Posture	Reps	Effort	Posture	Reps	Effort	Posture	Reps	Effort	Posture	Reps	Effort	Posture	Reps	Force	Posture	Reps	Index
Neck / Upper Back	6	1.5	15																			4.5
Dominant Upper Arm	6	1.5	30																			4.5
Non-dominant Upper Arm	6	1.5	30																			4.5
Dominant Forearm / Elbow	9	2	65																			9.0
Non-dominant Forearm / Elbow	9	2	75																			9.0
Dominant Wrist / Fingers	9	2	90																			18.0
Non-dominant Wrist / Fingers	9	2	110																			18.0
Trunk / Lower Back	6	1.5	15																			4.5
Legs (foot pedal)	3	1	100																			3.0

Acceptable Rotations:
Green – Green
Green – Yellow
Green – Red

Avoid if Possible:
Yellow – Yellow

Unacceptable Rotations:
Red – Yellow
Red – Red

Job Rotation Evaluator — Mechanized Assembly XPR 300

Rev date: 10/18/18

Muscle Groups	Workstation 1 Station 1	Workstation 2 Station 2	Workstation 3 Station 3	Workstation 4 Station 4	Workstation 5 Station 5	Workstation 6 Station 6	Workstation 7 Station 7	Workstation 8 Station 8
Neck / Upper Back	2.8	4.5	2.3	3.0	2.3	2.3	2.3	4.5
Dominant Upper Arm	3.2	4.5	4.5	3.0	2.3	4.5	4.5	4.5
Non-dominant Upper Arm	3.8	4.5	4.5	3.0	4.5	4.5	4.5	4.5
Dominant Forearm / Elbow	9.0	4.5	4.5	4.5	4.5	4.5	6.0	9.0
Non-dominant Forearm / Elbow	9.0	4.5	4.5	4.5	4.5	4.5	6.0	9.0
Dominant Wrist / Fingers	10.6	10.8	10.8	4.5	10.8	13.5	12.0	18.0
Non-dominant Wrist / Fingers	8.8	9.0	9.0	4.5	10.8	13.5	12.0	18.0
Trunk / Lower Back	3.2	4.5	2.3	3.0	2.3	2.3	2.3	4.5
Legs (foot pedal)	3.8	0.5	0.5	0.5	0.5	0.5	1.0	3.0

Introduction to *ErgoFactor* and *Fit-For-Work*

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Introduction to ΣrgoFactor

- In 2021, it was recognized that a better management system was needed to standardize the ergo evaluation process and create visibility/transparency to the engineering and leadership teams.
- Hypertherm developed an Ergo-Steering Team to generate team engagement and dive ownership to the team level.
- Purchased two new resources in 2022:
  - ErgoFactor
  - Fit For Work

Introduction to ΣrgoFactor

- ErgoFactor is a proprietary software system that provides Ergonomic Jobs Analysis. Benefits of the system include:
  - Standard analysis methodology to be used across all processes/operations.
  - An objective analysis tool that asks specific questions and requires specific inputs (opposed to subjective observations).
  - Data transparency and dashboards for all users (team leaders, engineers, EHS, etc.)
  - Training and education for all users.

- ErgoFactor system uses a proprietary risk assessment methodology that utilizes many established analysis methodologies, such as:
  - REBA, RULA, WISHA & NIOSH lifting, Strain Index, ACGIH-Hand Activity, etc.

Introduction to ΣrgoFactor

- Based upon analysis results, the ErgoFactor system generates relative risk-ranking data for each body part:
  - Alpha (high) Alpha (A)
  - Beta (medium) Beta (B)
  - Gamma (low) Gamma (Γ)
  - Delta (negligible) Delta (Δ)

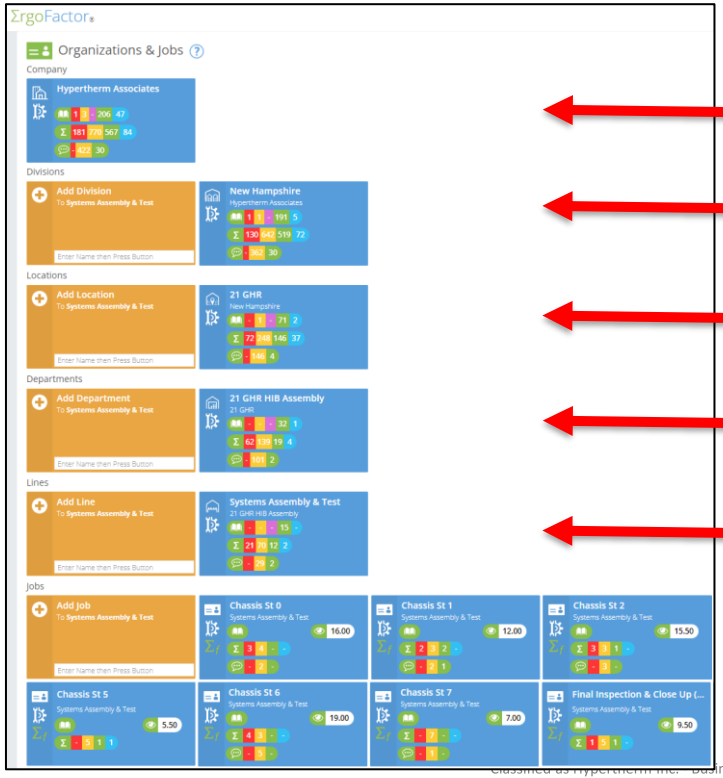
  - The completed analysis also generates an *ErgoLook* “Score” (higher score means more risk).
  - As a company policy, any Alphas and Betas must also generate a recommendation for improvement. This gives leaders and engineers a place to start.
  - Each team provides a monthly status update on their ErgoFactor progress. This provides team accountability to drive improvements.

Introduction to ΣrgoFactor

- ErgoFactor provides a dynamic dashboard with drill-down capability.

Introduction to ΣrgoFactor

- The ErgoFactor system provides a dynamic dashboard that organizes risk by:



Company

Region

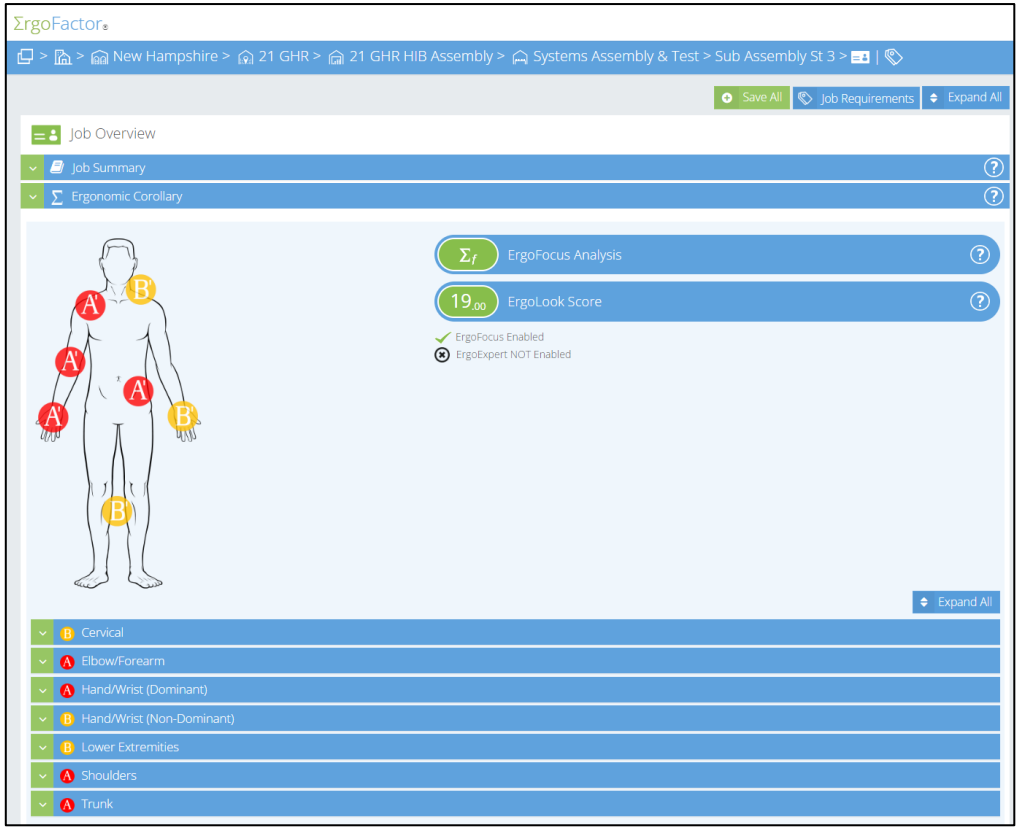
Building location

Team / Department

Cell / Line

Task / Workstation

Introduction to ΣrgoFactor



- Snapshot of individual ergo assessment

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ΣrgoFactor Summary

- Each “Alpha” high risk must generate a recommendation for improvement.
- Once “Alphas” are addressed, teams move on to “Beta” medium risk.
- Eash Team must report on their ergo status monthly to drive progress and accountability.
- The ErgoFactor system provides real-time risk data and is updated frequently. New jobs or tasks are captured with MOC process. Each assessment will expire annually, requiring re-approval.
- Other benefits include ergo data reporting:
  - Job-specific ergo data available to medical providers and WC carriers;
  - Job Restriction Analysis (find jobs that fit an employee’s restrictions).

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Introduction to FIT FOR WORK

- While ErgoFactor provides the risk assessment data and management system, *Fit For Work* provides the hands-on resource.

- *Fit for Work is a nationwide leader in injury prevention and workplace safety. Our multi-faceted strategic safety solutions and trained staff members and consultants keep people from all walks of life and different industries safe on the floor, and everywhere else.*
  - Industrial Ergonomics | Injury Prevention | Ergonomics | Fit For Work (wellworkforce.com)

Introduction to FIT FOR WORK

- Part-time presence (3 days/week - 24 hours/week total)
- Certified Athletic Trainer (ATC). Provides OSHA-defined First Aid treatment
  - stretching, deep muscle massage, hot/cold therapy, wraps and compression sleeves, etc.
  - Meets with associates across 10 building locations, 3 shifts.

- Primary responsibilities are to:
  - Assist with ErgoFactor assessments for both current and new processes/tasks.
  - Provide coaching and advice to teams (recommendations for ergo improvement, job-specific stretching, job rotation plans, employee training, etc.)
  - Provide one-on-one employee interaction to treat early signs and symptoms of injury (both work-related and personal medical issues).

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Introduction to FIT FOR WORK

ATTENTION HYPERTHERM ASSOCIATES

You can now submit a request 24/7 to be seen by your FFW Provider.

See us for the following:

- ⇒Early Aches & Pains
- ⇒Ergonomic Recommendations
- ⇒Workstation Assessments
- ⇒Health & Wellness Questions

Allison Purdue, ATC

Days/Hours Onsite:

Mondays: 9:00am-3:00pm
Wednesday: 6:00am-2:00pm
Thursdays: 8:00am-6:00pm

Scan the QR code below to access the **Fit for Work "Stay Healthy Link"**

https://ffwapps.com/stayhealthy

Company Code(s):	71Heater	325MSR	Airpark
	21 GHR	9GHR	15GHR
	82Etna	88Etna	100Etna

FFW available to meet with employees for both work-related and *non-work-related* issues.

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SUMMARY- Hypertherm Ergonomics Program

- Hypertherm's strategy is to identify and reduce ergonomic hazards as efficiently as possible.
  - With a robust risk assessment system and onsite resource.

- The *ErgoFactor* system provides the risk assessment tool and system to manage our ergonomic risk data across multiple buildings and states.

- The *Fit For Work* onsite resource provides expertise, guidance and assistance to Leaders and Engineers who are responsible for risk reduction initiatives.

- The *Fit For Work* onsite resource also meets with associates one-on-one to provide First Aid treatment to prevent minor discomforts from becoming medical treatment cases.

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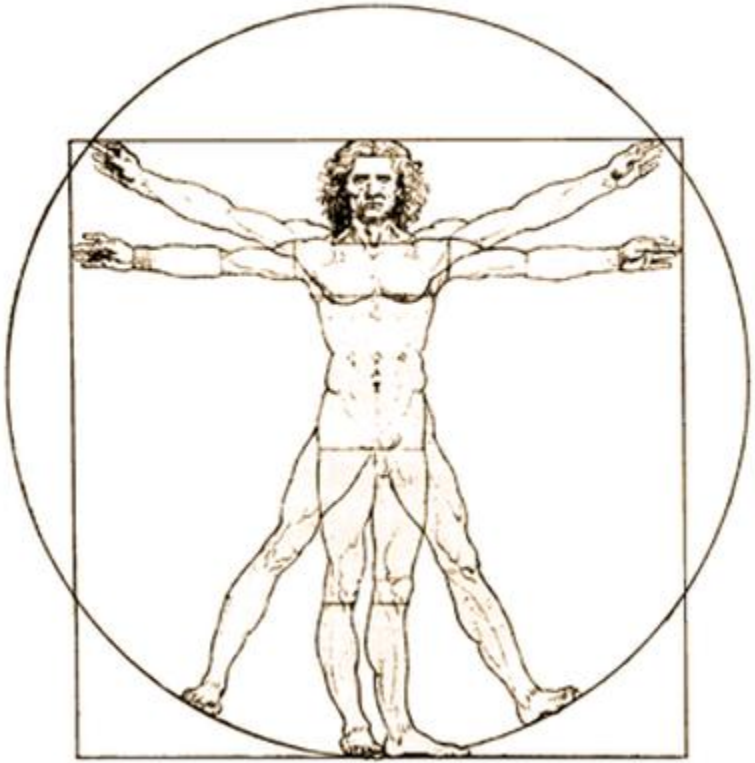
The End



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