

Typical Elements in Advanced Ergonomics Test Batteries

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The test batteries that AEI designs are tailored specifically to the physical demands of the jobs included in the client's testing program. Therefore, there is no standard test battery. There are common elements, though, that are included depending on the results of the job analysis. These elements fall in seven basic categories:

- Progressive single-lift strength tests;
- Push/pull tests;
- Climbing tests;
- Sustained awkward posture tests;
- Confined space tests;
- Step test (test of aerobic capacity); and
- Job simulations.

Each type of test will be briefly described below.

Progressive Single Lift Strength Tests

If there are substantial lifting demands that occur only occasionally, progressive single lift strength tests are designed to replicate those tasks. For case or box handling, the test begins with lifting an empty box of dimensions similar to what is lifted on the job through the range required by the job (e.g., from floor level to 60"). If the participant is able to safely lift an empty box, they are given the opportunity to add weight to the box in up to 20 lb. increments. The weight made available to add is slightly more than the test cutoff. This limit is in place to reduce the risk of injury during the test since there is no need to lift more than the cutoff. After each addition, they then demonstrate the ability to lift that weight. If they perform that safely, they are given additional opportunities to add weight until one of three end-points is achieved:

- 1) **Psychophysical Endpoint:** Voluntary termination by the participant due to fatigue, excessive discomfort or inability to complete a lift with more weight.
- 2) **Maximum Required Weight Endpoint:** The test would be terminated if the participant demonstrated the ability to lift the required weight in the prescribed manner.
- 3) **Early Termination Endpoint:** The test is terminated if the test administrator observes violation of pre-test instructed and demonstrated safety restrictions that indicate the participant is under undue stress or risk of injury.

If the job requires lifting something other than a box, that item is used for the test. For instance, a standard carry-on bag is used for strength tests in batteries for Skycaps, Airport Shuttle Drivers, and Ramp Agents (employees who load and unload airplanes).

Push/Pull Tests

When there is a substantial push or pull force requirement, the task(s) is simulated by setting an isometric force gauge at the height of the push or pull, and asking the participant to perform the required exertion. Up to three opportunities are given to meet the requirement. If the requirement is met on the first or

second trial, the test is concluded at that point. Isometric tests are typically used because the peak force requirement typically is encountered at the initiation of the push or pull.

Climbing Tests

If the job requires climbing stairs or ladders, the participant is asked to demonstrate the ability climb in the required manner(s) (e.g., stairs, inclined ladder and/or vertical ladder) the amount required by the job. If the job requires climbing a vertical ladder to, say, 40 ft., the test may be designed to climb up and down five feet eight times.

Sustained Awkward Posture Tests

For jobs that require working for extended periods in an awkward posture (e.g., hands held overhead, fully extended in front of the body, or at floor level), a test of the ability to sustain that posture is included. A test would typically involve performing light hand work such as attaching and detaching nuts on bolts with the hands in the required posture. The participant is asked to perform that task for the longest time routinely encountered on the job at issue. A typical test time is on the order of two minutes.

Confined Space Tests

Some jobs require employees to move through tight spaces such as a man hole. In those instances, the test participant is asked to demonstrate the ability to move through that size opening oriented as it is on the job (e.g., a 16" by 20" portal in a wall where the portal is 12" above the deck).

Step Test (Assessment of Aerobic Capacity)

For jobs with sustained substantial energy expenditure requirements, a step test is included in the battery. An example of this type of job would be full-case grocery selecting, which can involve lifting cases with an average weight of 25 lbs. 200 times an hour for an eight to ten hour shift.

The candidate wears a commercially available heart-rate monitoring device while stepping on and off a 10" high bench at a pace set by a metronome. After three minutes of stepping at a rate of 17 steps per minute, the heart-rate is recorded. If the heart-rate is less than 65% of the estimated maximum heart-rate, the candidate rests for one minute then performs three more minutes of stepping at a rate of 26 steps per minute. If the heart-rate at the end of the three minutes of work is still below the target rate, the candidate rests another minute and performs three minutes of stepping at 34 steps per minute. The data from the step test is entered into a series of equations that estimate the maximal oxygen uptake of the individual on the basis of that data.

Work Simulation

For jobs that have bouts of substantial energy expenditure, such as intervals of three to twenty minutes, the task(s) associated with those bouts of substantial energy expenditure would be simulated in the clinic. A job of this nature would be the Ramp Agent unloading baggage on an arriving flight and then loading baggage on that same plane for the outbound flight. The simulation might be something like demonstrating the ability to move a bag of average weight through a prescribed pattern a set number of times within the period of time allowed for completion of the task on the job. The average bag weight, number of repetitions and length of time allowed would be determined during the job analysis.

Summary

The complexity of a given test battery depends on the nature of the physical demands identified in the job analysis. Where there are significant occasional strength demands, those tasks are simulated by asking the test participant to exert force in the required manner (e.g., lift, push or pull) through the required range. Ability to perform sustained postural and agility requirements are assessed by having the test participant perform a simulation of the given task (e.g., perform light handwork with hands at floor level for two minutes, or climb an inclined ladder to a height of five feet). Ability to work at a substantial energy expenditure for an extended period is assessed with a step test when the demand is consistent for a period such as an entire shift, or a work simulation when the demand occurs in bouts of approximately twenty minutes or less.