Introduction

Fitness for duty testing is a valuable component of a comprehensive safety program and creates fertile ground for safety professionals to conduct critical analyses of essential job demands and methods to reduce risk factors associated with each job. Fitness for duty (FFD) testing can be conducted legally and effectively to identify whether or not an individual is able to perform the essential physical functions of a particular job prior to job placement. This process involves assessing a person’s functional capabilities and identifying any existing physical deficits in order to determine whether or not a person can safely perform the essential functions of a job.

FFD testing must be designed to meet the standards of the Americans with Disabilities Act (ADA) and other acts such as ADEA to avoid disparate discrimination of protected classes as required by the Equal Employment Opportunity Commission (EEOC). Protected classes technically include all women, all people 40 years of age and older, and anyone with a real or perceived disability. Therefore, it is critical that the safety professional fully understands current laws and guidelines related to federal acts that protect the employee from disparate discrimination in the hiring and return to work process.

FFD tests can identify persons who have cardiovascular and/or musculoskeletal disorders and who may be exposed to imminent risk of injury. It can also be used to establish a pre-injury baseline profile of employees to aid in the rehabilitation should they become injured and to provide accurate accommodations required for people who may have disabilities protected by the ADA. In order to help ensure that a FFD testing program will be legally defensible and effective for its intended for purpose, the safety professional should be involved in the validation process to determine the essential demands of each job are correctly identified and measured.

Conducting a Valid Physical Demand Validation (PDV)

In order to avoid hiring discrimination, any determination of whether or not an employee can perform a job task safely must be based on essential job functions that have been validated. Validation is most commonly based on data derived from an on-site job analysis called a physical demand validation or PDV. Physical demands validations (PDVs) involve detailed interviews of employees and first line managers in each job title and a systematic job analysis. The PDV is essential to assess and measure the essential functional (or physical) demands of a job. Essential
functional demands of the job can be defined as the minimum physical demands required of the worker in order to perform job functions safely that are considered to be of business necessity. For example, a task of transferring packages in a warehouse weighing 10 - 35 lbs from a delivery truck to a conveyor belt on a daily basis may be considered essential if other reasonable ergonomic solutions are not available or feasible. However, requiring an employee to lift a water pump that weighs 100 pounds by himself or herself that is delivered once a month and can be handled by more than one employee or by a mechanical lift device, would not be considered an essential job function. In other words, requiring a conditional new hire to perform a lift test involving 100 pounds for job placement, in this example, would fail to meet the legal requirement of content validity and would therefore, not be an appropriate or valid test for hiring determination. The safety professional should be one of the key representatives of the company to help ensure that a FFD testing healthcare vendor performs only FFD tests that use valid job-specific functional criteria for pass/fail determinations.

Once a PDV of a job is completed, the results of this analysis is then translated into a comprehensive functional job description (FJD). The initial draft of a FJD should always be submitted to review by experienced employees and management personnel who are most knowledgeable about the job that was analyzed. Once the FJD is approved after the review process, data from the validated FJD can be used by the FFD testing clinician to customize the FFD test for proper content-valid testing of job demands in the clinic.

A PDV is conducted using tools that measure force, weight, distance, and angles, cameras for still shots and videography, and employee/manager interviews for verification of data. A safety professional should use the following tools to perform a PDV:

a. pen and paper or electronic recorder to record data  
b. push/pull dynamometer gauge  
c. weight scale  
d. tape measure  
e. inclinometer to measure angles  
f. still and video camera  
g. heart rate monitor (unless heart rate is assessed manually)

It is apparent, if nothing else for legal reasons, that the PDV process must be performed skillfully. A PDV should assess material handling demands (i.e., lifting, carrying, pushing and pulling) with an accurate quantification of variables such as weights, dimensions of the material handled, frequency of handling, vertical distance at the origin and termination of the lift, distance the object is moved, horizontal distance of the material handled from the body, coupling characteristics, distance carried, etc. (A PDV data collection form can be acquired by going online to www.WorkSaverSystems.com or contacting the author.)

The safety professional should realize that there is a difference between an essential job demand criterion for FFD testing, and what is actually being conducted by employees on the actual job site. Ask a group of employees how much they have to lift at work and you will usually get quite a variety of answers. The variation in answers will most likely be due to the fact that some employees do not use proper mechanical assistive devices or abide by safety guidelines to lift correctly, whereas other employees do. The safety professional must keep in mind as a representative of his organization that in order to acquire legally compliant physical demand data,
his job is to help identify the minimum essential criteria of a job for the purpose of nondiscriminatory job placement. By not truly representing the minimum essential lifting demands of a job, the employer can be inadvertently discriminating against protected classes (females, older employees and the disabled) if the FFD tests are excessive and not valid for the job.

**Conducting the PDV**

**Analyzing Lifting Tasks**
When analyzing lifting, the safety professional should use an accurate weight scale and measure the dimensions of the object being lifted. The type of coupling, such as cutouts or handles, should be described. It is important to understand that not every single type of material or tool needs to be weighed and measured. The key here is to weigh and measure weights of materials and tools that represent the most demanding materials that are essential to be manually handled. It will not be useful to have every little object measured for the purpose of FFD testing. That being said, there is no harm to conduct a more detailed analysis of all materials being handled for the purpose of creating a detailed FJD.

When lift task involved lifting an object to a specific height, it is best to use the criteria of the NIOSH lift equation for assessing parameters of lifting. These parameters include the following:

a. the vertical distance from the floor or ground to hand placement upon the initiation of the lift
b. the vertical distance from the floor to the termination of the lift (hand placement)
c. the horizontal distance from the body to hand placement on the object being lifted
d. the distance traveled during the lift (the absolute value of the vertical distance at the origin and destination of the lift)
e. the angle of rotation (degree of twisting required)
f. the frequency of the lift based on the number of this per minute
g. the quality of the coupling of the lift (good, fair, poor)

(Refer to the NIOSH lift equation online or in publication by OSHA for more information.)

When there is a lift that is not based on a fixed height, the lift should be described according to anthropometric criteria such as floor to knuckles, floor to waist, floor to shoulders, or floor to overhead. If there are variations in the origin and destination of a lift task, choose the most demanding criteria that are essential to perform the job. Remember, the PDV analysis should have good inter-rater reliability, meaning that another independent evaluator should be able to derive the same data that you derived from your PDV analysis.

**Analyzing Carrying Tasks**
When measuring carrying requirements, the safety professional should realize that ergonomic specialists will consider most carrying tasks as not being essential tasks and as tasks that can be easily eliminated by mechanical assistance (e.g., cart, forklift, conveyor belt, etc.). However, if carrying is truly manually required and cannot be eradicated by simple ergonomic interventions, then the safety professional should record the weight and dimensions of the object being carried, the distance carried, the frequency of carrying, and whether or not carrying can be performed with two hands or only one hand.
Tasks requiring one-handed carrying up and down stairs are very important to document. Such a task will require good coordination, balance, depth perception, and good cardiovascular endurance. To assess the energy expenditure impact of carrying while climbing, a person’s heart rate should be analyzed at rest prior to carrying an object and upon completion of carrying the object. Obviously, heart rate measurements will vary depending on the aerobic condition of the person. Therefore, this data should be taken from as many employees performing this task as possible. Heart rates have a direct linear relationship to energy expenditure and can provide a safety professional with key information on the energy demands of the job task. For example, heart rates have been correlated to physical demand levels and lifting as shown below:

<table>
<thead>
<tr>
<th>Physical Demand Level (PDL)</th>
<th>Heart Rate (bpm)</th>
<th>Occasional Lift</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedentary</td>
<td>70-80</td>
<td>10 lbs / sitting</td>
</tr>
<tr>
<td>Light</td>
<td>81-90</td>
<td>20 lbs</td>
</tr>
<tr>
<td>Medium</td>
<td>91-110</td>
<td>50 lbs</td>
</tr>
<tr>
<td>Heavy</td>
<td>111-130</td>
<td>1—lbs</td>
</tr>
<tr>
<td>Very Heavy</td>
<td>Over 130</td>
<td>Over 100 lbs</td>
</tr>
</tbody>
</table>

Carrying while climbing stairs, of course, should never involve both hands to carry, and one-handed carrying should be carefully analyzed for essentiality. The safety professional should always try to determine if carrying whole climbing stairs can be reasonably engineered out by ergonomics.

The safety professional must consider that although a person may carry an object a certain distance on the job, consideration must be given to whether the person can reasonably stop carrying to rest and then return to carrying after the rest period. Obviously, there is subjective interpretation of how many rest periods can be considered reasonable to carry an object from point A to point B. If a certain frequency and duration of breaks interferes with job productivity or safety, then the rest breaks that fall within those parameters should not be considered acceptable. The challenge is to come up with a minimum carrying distance that can be translated into a fit for duty test that will be considered by any critic to be reasonable. It is important to indicate in the PDV report the amount of time allowed to rest between carrying repetitions. This information will be important for translating a repetitive carrying test protocol in the clinic during a FFD test.

Analyzing Push/Pull Forces
Pushing and pulling involves forces and not weight. To understand the difference, to lift a box that weighs 50 pounds, a person will have to generate a lifting force that exceeds 50 pounds. If a lift force is equal to or less than 50 pounds in this scenario, the 50 lbs box will not move. Pulling and pushing tasks vary and are related to such tasks as pulling a wrench, pushing a cart, tilting a 55 gallon drum, breaking a valve, etc.

There are two main parameters that should be measured when analyzing pushing and pulling tasks. They are peak force and sustained force. For purposes of FFD tests, it is much more objective and reliable to assess a person’s capacities to generate the required peak force that has been validated on a job rather than sustained push or pull forces. This is because sustained push and pull forces will vary and as such, are difficult to properly simulate in a testing facility. For example, the peak force required to start moving the heavy tool cart can be consistently measured.
as long as the tool cart is assessed in the same environment. However once the cart begins to move, the sustained force to keep it in motion will depend on variations in the floor surface and changes in the coefficient of friction. The sustained force, for example, will change when the cart is being pushed up an incline or down a decline or over a threshold. That being said, if sustained forces to move a cart are substantial, then effort should be made to provide an average push or pull force and distance travelled (if applicable) for job tasks simulation and FFD test design. In addition to measuring peak and sustained forces, the height of hand placement during pushing and pulling should be measured above the floor/ground to allow a valid push/pull replication when creating a FFD test.

Remember, if a push or pull force can be easily reduced by simple interventions such as lubricating a valve stem, or enlarging the casters on a cart, the forces required without these no or low cost interventions cannot be accepted as being essential physical demands. In addition, if a push or pull can be performed by two or more people without creating a hardship or interfering with job productivity, the amount of force required must be divided among the number of people conducting the push or pull. Therefore, if 150 pounds of average push force is required to move an object and can be conducted by two people, the required force per person would be calculated as 75 pounds of force.

The proper tool for measuring push and pull forces is a push pull dynamometer. When used for job analyses, it is essential to make sure that these dynamometers are accurately calibrated. To use a dynamometer correctly, the instrument must be used to generate the force in the same direction as applied by the employee. For example, when measuring the pull force to tilt over a 55 gallon drum to load onto a dolly, the dynamometer should be attached to the top of the 55 gallon drum where the hands would be placed, secured, and then pulled in the same direction and with the minimum amount of acceleration as would be required to conduct this job task safely. Remember the well known equation, \( F = M \times A \) (force is equal to mass times acceleration). Therefore, a force generated greater than a minimum essential requirement may be inadvertently measured if a person pushes or pulls on a dynamometer with a high rate of acceleration. For example, jerking on the top of a 350 lb, 55 gallon drum to tilt it in order to place it onto a dolly can result in very high pull forces that exceed 250 pounds. A slower, more controlled pull can generate a pull force well under 100 pounds. This is important to know because this pull force when used in the clinic to test a person’s ability to perform this task needs to represent the minimum essential requirement, not more.

**Analyzing Postural Demands**

Another important component of a PDV analysis is to analyze postural demands. Again, the safety professional should use this opportunity to minimize or eradicate sustained or highly repetitive awkward work postures. That being said, in most labor intensive jobs there will be essential postural requirements related to overhead reach, body twisting, crawling, stooping, squatting, and kneeling. Working in cramped or confined spaces may create a mandatory requirement that an employee be able to work in awkward postures. When these requirements do exist, it is important to notate the frequency and duration of the postures.

**Analyzing Stair and Ladder Climbing Tasks**

Other key aspects of the PDV analysis is it determine requirements related to climbing stairs, slanted ladders, and vertical ladders. The energy demands to perform these tasks increase in the order listed. The data collected on these tests should include the repetition required within a
typical workday, the number of steps or rungs that have to be climbed, and whether or not the employee must wear a tool belt or special clothing that will add weight to the person during the climb. Again, resting heart rate should be measured in the field prior to performing the task and again upon completion of the task. A sampling of a stair ladder climbing task for the purpose of constructing a FFD test can, for example, involve 20% of the total number of climbing repetitions performed in a day with the minimum test construct being one total repetition. There is no scientific data to determine the most appropriate determination of repetitions for a FFD test. Again, in determining a representative FFD test to assess a person’s capacity to climb stairs or ladders based on the PDV, it is important to be reasonable and not to create a test simulation in a clinic that would be unrealistic or excessively stressful.

**Analyzing Environmental Demands**

Environmental demands of the job may also be important to consider especially when there is extremes in temperatures. However, the safety professional should realize that most testing clinics that perform FFD tests cannot simulate the actual environmental demands of the job while testing. In fact, any attempt to do so may actually create a disparate testing environment. For example, testing a person wearing Arctic gear in an extremely cold environment so that the test recipient’s abilities to complete the task can be analyzed may seem reasonable. However, if the same cold environment cannot be reproduced at the FFD test clinic for the same job title during the summer months, then testing would not be conducted equally among all test recipients. Safety professionals should always realize that fit for duty testing should never require tests that actually exceed the minimum requirements both from a physical demand perspective and environmental demand perspective.

**Validity of FFD Testing**

The U.S. Department of Labor has defined discrimination, as it relates to post-offer, pre-placement testing, as “the use of any selection procedure which has an adverse impact on the hiring, promotion, or other employment” of individuals (41 CFR 60-3.3). Consideration of suitable selection procedures may be determined to be discriminatory if not validated.

The U.S. Department of Labor indicates there are three acceptable forms of validity studies: criterion-related, content, and construct validity. Evidence of the validity of a test or other selection procedure by a content validity study should consist of data showing that the content of the selection procedure is representative of important aspects of performance on the job for which the candidates are to be evaluated. The safest way to conduct a fitness for duty program is to determine whether or not an individual demonstrates sufficient functional capacities to safely perform the minimum essential duties of a job. From this perspective, it is the opinion of the author that content validation is the best validation approach to FFD testing. A FFD test based on content validity is not designed to predict future work performance. It is designed, rather, to determine if the person is safe to be hired on the day of the evaluation. Period. After all, it is opined that it is in reality impossible for any test to predict with acceptable accuracy and reliability (at least for the legal purposes of hiring) whether or not a person will work safely in the future. For example, no test can reliably predict that an employee, once hired, will not gain significant weight that can adversely affect future work performance, and/or become deconditioned due to lack of exercise, and/or develop a disabling disease. Therefore, content validity is essential for designing an appropriate FFD test to avoid disparate discrimination in any form of job placement whether it be for new hires or return to work after injury.
The safety professional is best suited to understand demands of each job that he or she is responsible for in maintaining safety. Also, knowledge of past injuries incurred in a job may create a focus on how to reduce risks while the same time reducing the physical demands of the job. Through this process of critical analysis of job safety and PDVs, the safety professional can incorporate ergonomic interventions and administrative changes that will help ensure the correct identification of the minimum essential functions of a job derived from a physical demand validation.

**What the Safety Professional Should Know about FFD Design for both New Hires and Return to Work Following Injury/Illness**

Post offer, preplacement FFD tests are conducted only after a conditional offer of hire is presented to the applicant. New hire FFD tests cannot be conducted selectively or randomly. It must be applied to everyone across the board who applies for the job title being tested. A fit for duty test can be conducted selectively on an incumbent employee for cause. EEOC has identified the following 5 situations justifying a FFD test for cause on incumbent employees:

a. Following a request for accommodation.
b. When observing performance problems related to a known medical condition.
c. When observing symptoms indicating a possible medical condition that threatens safety.
d. When there is receipt of “reliable information” that an employee has a medical condition that threatens safety.
e. Following return from leave when employer has a reasonable belief that employee’s ability may be impaired and threatens safety.

FFD tests can be conducted for incumbent employees across the board for a specific job title at regular time intervals (e.g., annually, every 3 years, etc.) if there is a justified business necessity to ensure safety. Typically the FFD test in these cases are justified due to a definitive increased risk of injury with time should an employee’s level of physical fitness or functional capacities decline to a certain level. Examples of such jobs that would present a business necessity for cyclic FFD testing to ensure safety are fire fighters, police/security forces, first responders, etc.

Medical questionnaires and baseline medical examinations can be legally conducted (and should be conducted) in conjunction with job-specific functional tests as long as medical information derived from these methods are used only to ensure safety for engagement in functional testing and not used in and of itself to determine pass/fail criteria. If a medical exam has no relevance to job performance, then it cannot be used to determine if a person is fit for duty.

Medical or health information derived from questionnaires and medical examination procedures allow the FFD testing clinician to assess for any signs of a pre-existing medical conditions that could warrant caution and/or a referral for a medical release prior to allowing the test recipient to undergo the more physically strenuous components of job-specific functional testing. FFD tests used for assessing fit for duty for an incumbent employee following injury or illness should only include medical examination tests that are required to determine if the person is safe to undergo job specific functional testing.
The testing format of a FFD test or exam is divided into two major components involving the following:

1. Baseline Physical Data Collection:
   - Musculoskeletal (e.g., posture, muscle strength, joint range of motion, etc)
   - Neurological exam including assessment of reflexes, balance, and coordination
   - Cardiovascular examination (e.g., recording of blood pressure and heart rate)
   - Aerobic capacity testing (e.g. YMCA Step Test)
   - Special tests as dictated by medical history (e.g. knees laxity test)

2. Validated Job-Specific Functional Tests
   - Lifting and carrying
   - Pushing and pulling
   - Stair and ladder climbing
   - Stooping, kneeling, squatting, reaching, etc.

**Identifying Pre-Existing Medical Conditions / Impairments**
Baseline measurements for measuring joint range of motion, muscle strength, balance and coordination, resting heart rate and blood pressure, sit and reach flexibility, grip strength, and aerobic fitness level are useful data to determine the pre-injury status of the new hire. Impairments such as loss of range of motion, focalized muscle weakness, and sensory loss may not actually interfere with job specific functions. The FFD test allows objective recordings of these even though the impairments may not interfere with job placement.

The importance of recording pre-existing impairments exists in situations in which an on-the-job injury occurs. For example, when an employee injures his neck at work, without a pre-injury baseline recording, how does one know that the loss of range of motion in the neck recorded after the injury was a direct consequence of the injury? For instance, what if the impaired cervical range of motion was actually the result of a pre-existing football injury? Documented proof of loss of range of motion due to an old football injury, as used in this example, at the time of hire can potentially save the employer significant costs associated with a legal settlement for a physical impairment that was not caused by an injury at work.

**Lift Capacities Testing**

Lift capacities tests conducted during a FFD test are conducted to determine if the test recipient exhibits sufficient lifting strength to safely perform the essential lifting demands of the job both in context of weight and repetition requirements. Prior to and during the FFD test, the test recipient should be instructed on proper body mechanics and safe lifting techniques. As a safety measure during lift testing, weights should gradually be added to a lift box on a standardized, progressive basis while assessing body mechanics, heart rate, and the person’s perception of how stressful the lift becomes (using a lift stress or psychophysical chart). The determination of a person’s maximum safe lift capacity is determined mainly by 4 main types of limitations:
1. **Kinesiological Limitation** – Testing is terminated when changes in body mechanics during lifting begin to occur that involve compensatory body motions that signal inability to exhibit proper neuromuscular control.

2. **Psychophysical Limitation** – Testing is terminated when the applicant reports, using a psychophysical response chart, a self-perceived rating of the weight being too heavy to handle safely.

3. **Symptom Limitation**: Testing is terminated if the applicant reports any symptoms such as pain, dizziness, numbness, pins and needles, nausea etc. that are deemed indicative of an adverse response to testing.

4. **Cardiovascular Limitation**: Heart rate and blood pressure are monitored carefully during tasks that are expected to create significant cardiovascular demands. Irregular and/or excessive heart rate and abnormal blood pressure responses resulted in termination of testing and referral to a medical physician.

### Withdrawal of Conditional Offer of Hire

A conditional offer of employment may be withdrawn if the applicant is determined from testing to be unable to perform the functional abilities to perform the essential functions of the job without being at immediate risk of injury to self or co-workers and when there are no reasonable accommodations available. In some cases, medical concerns may be apparent prior to the actual job-specific functional testing component of the FFD test. The physical examination conducted prior to functional testing may reveal symptoms or a medical condition that renders the test recipient unsafe to undergo the physical demands of the job-specific work simulation tests. In such cases, the testing is terminated prior to any stressful functional tests. The individual is then informed of the finding and is instructed to consult a healthcare provider to assess and/or correct the problem and acquire a medical release in order to resume the functional testing process at a later date. The manner in which this is handled administratively by the testing clinic and employer is critical. The administrative handling of all cases that require test termination and a medical release must be conducted consistently and equally at all times. This is essential to avoiding claims of disparate discrimination in the hiring process.

Employers should develop a policy for re-testing of conditional new hires who are determined to be unable to undergo functional testing due to a medical finding (e.g., high blood pressure) that is fair and equitable. This process should be a win-win relationship between parties, the prospective employee and employer. By making a prospective employee aware of a medical condition that requires treatment, the employer helps to ensure his/her safety at work. Once the identified condition is remedied, the employer can then complete the FFD test and place the individual in the job with reduced risk of injury.

The FFD test failure rate will vary depending on the physical demands level of the job. A failure rate will typically range from 1% to 3% for jobs classified in the “light” physical demand level (PDL) classification, 5% to 8% for jobs classified in the “medium” PDL classification, 9% to 12% for jobs that fall within the “heavy” PDL classification, and 18% to 23% for jobs classified in the “very heavy” PDL classification. PDL classifications in the United States are defined by the U.S. Department of Labor.
Summary

Safety professionals can play an important role in the development of a properly performed FFD testing program. FFD tests provide a highly effective system to safely match new hires and also return-to-work cases to essential job physical demands. When designed correctly, the FFD test can be instrumental to a safety program and provide the most comprehensive, valid, and effective type of evaluation for safely matching a person’s capacity to the essential functions of the job following EEOC and ADA guidelines.

As previously pointed out, a FFD test can prevent injuries related to improper job demands matching and measure pre-existing impairments that can be used for second injury fund coverage and/or avoidance of future claims for an impairment that was pre-existing at the time of hire. In addition, the evaluation system can be used to teach the new hire proper body mechanics and can provide personal wellness feedback based on the physical assessment and functional performance results.

The net result of this type of evaluation system is that the employer is much less likely to hire a person who will become injured soon after job placement while performing the essential duties of a job. This will translate into a better qualified work force and improved productivity. In addition, the employer will be protected against inappropriate claims of injuries that are related to pre-existing injuries. On a national scale, FFD tests are proving to be the most effective system for matching employees to the job and reducing injuries and claims. Safety professionals should seriously consider recommending a FFD testing program to their human resources department and integrating FFD testing as an integral component of a corporate wide ergonomics and safety program.

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