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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

ED 060128

TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

Spot-Welder Feeder (welding) 819.886

S-89

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
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U. S. Employment Service in
Cooperation with
Pennsylvania State Employment Service

U. S. DEPARTMENT OF LABOR
Bureau of Employment Security
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STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY
FOR
Spot-Welder Feeder (welding) 819.886-010

S-89

Summary

The General Aptitude Test Battery, B-1002A, was administered to a sample of fifty women employed as Spot-Welder Feeders at the Emporium Specialties Company, Austin, Pennsylvania. The criterion consisted of production records based on average welds per hour for a four week period of employment. On the basis of mean scores, standard deviations, correlations with the criterion, job analysis data and their combined selective efficiency, Aptitudes K - Motor Coordination, F - Finger Dexterity, and M - Manual Dexterity were selected for inclusion in the test norms.

GATB Norms for Spot-Welder Feeder (welding) 819.886 S-89

Table I shows, for B-1001 and B-1002, the minimum acceptable score for each aptitude included in the test norms for Spot-Welder Feeder (welding) 819.886

TABLE I

Minimum Acceptable Scores on B-1001 and B-1002 for S-89

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
T	CB-1-G CB-1-K	75	K	Part 8	80
F	CB-1-O CB-1-P	90	F	Part 11 Part 12	85
M	CB-1-M CB-1-N	75	M	Part 9 Part 10	75

Effectiveness of Norms

The data in Table IV indicate that 10 of the 17 poor workers, or 59 percent of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 59 percent of the poor workers would not have been hired if the recommended test norms had been used in the selection process. Moreover, 26 of the 33 workers who made qualifying test scores, or 79 percent, were good workers.

TECHNICAL REPORT

I. Problem

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupation of Spot-Welder Feeder (welding) 819.886

II. Sample

The General Aptitude Test Battery, B-1002A, was administered on October 18, 19, and 20, 1955 to fifty-one women employed as Spot-Welder Feeders by the Emporium Specialties Company, Austin, Pennsylvania. The tested sample included all of the women employed on this job except those over forty-seven years of age. One woman was eliminated from the sample because criterion data were not available for her. The final sample, therefore, consists of fifty women.

All training is given by the Manager who feels that a two week training period is sufficient to learn the job. There are no hiring requirements other than that all employees must speak, read and write English. The selection of applicants is made by the Manager on the basis of an informal interview. Tests have not been used in the selection process.

Table II shows the means, standard deviations, ranges, and Pearson product-moment correlations with the criterion for age, education and experience.

TABLE II

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education and Experience

Spot-Welder Feeder (welding) 819.886

N = 50

	M	σ	Range	r
Age (years)	29.2	8.7	17 - 47	-.095
Education (years)	10.6	1.7	7 - 12	.130
Experience (months)	13.6	14.7	1 - 48	.028

The correlations shown in the above table are not significant. The data in Table II indicate that this sample is suitable for test development purposes with respect to age, education and experience.

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III. Job Description

Job Title: Spot-welder feeder (welding) 819.886-010

Job Summary: Spot-welds small parts of television picture tube electron guns, using an automatic electric spot welder to join parts. Places parts in machine and spaces welds on straps to insure secure fastening.

Work Performed: Welds studs: Picks up one stud with tweezers from pile on table, quickly inserts stud in vise of welder with tweezers, taking care to enter stud upright. Turns handle of vise with fingers to close jaws. Picks up one cup (cylindrical sheet metal stamping) or metal cylinder from pile on table and slips it over fixture of welder, making sure cup or sleeve is against stop and that cylinder with slanted ends is fully in so that first stud is properly located. Depresses pedal to make weld. Turns or slides assembly to bring first stud against stop and welds second stud in same manner. Continues to turn assembly or move sidewise by deft movements of the hand and forearm and spot welds additional pins in place. Pulls completed part off fixture and throws it into a box.

Welds straps: Picks up one cup or cylinder from a pile on table and deftly slips it over fixture, taking care to push cylinder with slanted ends in as far as possible so first pin is properly located. Picks up one strap from pile, turns it so that internal radius is against cup or cylinder and edge is against stop to get proper spacing. Depresses pedal to make center weld and then deftly turns assembly on fixture with fingers to one side and then to the other to make more welds. May turn assembly over and repeat with strap on other side or may make four welds on some styles of straps, spacing welds by movement of hand to rotate assembly as before. Pulls completed piece off fixture and throws it in a box. May weld straps to each other after they are welded to cup or cylinder.

Inspects parts: Visually examines straps, cups, and cylinders for cracks, bends or ridges and discards defective pieces in shrinkage box. May break crooked studs with tweezers and replace with new studs. Keeps simple record of pieces completed.

IV. Experimental Battery

All of the tests of the GATB, B-1002A, were administered to the sample group.

V. Criterion

The criterion consists of the average number of welds per hour based on a four week period. This period covered the last two weeks in October, 1955 and the last two weeks in November 1955. The job is very easily learned and production status is reached in a short period of time. Performance over a period of four weeks was considered to be a good basis for obtaining a reliable measure of job performance for this group of workers. The criterion scores, which are expressed in terms of average number of welds per hour, range from 1777 to 6318, with a mean of 3177 and a standard deviation of 772.

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VI. Statistical and Qualitative Analysis

Table III shows the means, standard deviations and Pearson product-moment correlations with the criterion for the aptitudes of the GATB. The means and standard deviations of the aptitudes are comparable to general working population norms with a mean of 100 and a standard deviation of 20.

TABLE III

Means (M), Standard Deviations (σ), and Pearson-Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB

Spot Welder Feeder (welding) 819.884

N = 50

Aptitudes	M	σ	r
G-Intellignece	93.8	15.4	.210
V-Verbal Aptitude	96.7	13.8	.086
N-Numerical Aptitude	94.4	16.3	.231
S-Spatial Aptitude	92.7	18.6	.279*
P-Form Perception	105.3	19.4	.330*
Q-Clerical Perception	100.7	14.1	.335*
K-Motor Coordination	102.6	17.2	.123
F-Finger Dexterity	99.3	20.2	.399**
M-Manual Dexterity	93.0	20.3	.304*

** Significant at the .01 level
* Significant at the .05 level

The statistical results were interpreted in the light of the job analysis data. The job analysis indicated that the following aptitudes measured by the GATB appear to be important for this occupation:

Form Perception (P) - required to detect defects in visual examination of straps, cups and cylinders for cracks, bends or ridges in order to discard defective pieces.

Motor Coordination (K) - required in putting stud in vise, deftly slipping cup or cylinder on fixture, placing strap on cup or cylinder, spacing welds on strap by eye, quickly rotating fixture between welds, and deftly slipping completed piece off fixture to put it in box.

Finger Dexterity (F) - required in taking one cup or cylinder from pile, turning it and slipping it on fixture; also in picking up one strap or one stud with tweezers and positioning it for welding.

Manual Dexterity (M) - required in reaching for parts and unloading fixture by deft movements of hand and forearm and in rotating fixture to distribute welds properly.

The highest mean scores in descending order of magnitude were obtained

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for Aptitudes P, K, Q and F, respectively. All of the aptitudes, except Aptitudes F and M have standard deviations of less than 20. Aptitude V has the lowest standard deviation.

When N = 50, correlations of .361 and .279 are significant at the .01 level and the .05 level of confidence, respectively. Aptitude F correlates significantly with the criterion at the .01 level. Aptitudes S, P, Q and M correlate significantly with the criterion at the .05 level.

Aptitudes P, K, F and M were considered for inclusion in the test norms on the basis of the quantitative and qualitative factors cited above. Aptitudes P, K, F and M appear to be important in terms of the job analysis data; in addition, Aptitudes P, K and F show relatively high mean scores and Aptitudes P, F and M correlate significantly with the criterion. Tetrachoric correlations with the criterion were computed for several sets of trial norms consisting of various combinations of Aptitudes P, K F and M and appropriate cutting scores. However, the addition of Aptitude P tended to lower the selective efficiency of norms in which it was tried. Therefore, Aptitude P was excluded from the final test norms, which include Aptitudes K, F and M.

The cutting score for Aptitude K was set at the five-point score level nearest to one standard deviation below the mean and then adjusted to the next lower five-point score level. The cutting score for Aptitude F was set at the five-point score level nearest to one standard deviation below the mean and then adjusted to the next higher five-point score level. For Aptitude M the cutting score was set at one standard deviation below the mean and rounded to the nearest five-point score level. Setting cutting scores at these levels yielded the best selective efficiency for the norms and resulted in critical scores of 80, 85 and 75 for Aptitudes K, F and M, respectively.

Although there is some statistical evidence to warrant preliminary consideration of Aptitudes S and Q for inclusion in the test norms, neither of these aptitudes appeared to be sufficiently important on the basis of job analysis data to warrant further consideration.

VII. Concurrent Validity of Norms

For the purpose of computing the tetrachoric correlation between the test norms and the criterion and applying the Chi Square test, the criterion was dichotomized with 2900 welds per hour as the critical score. This is the number of welds per hour that the company feels would represent a reasonable minimum for a worker's performance to be regarded as satisfactory. Those workers who averaged 2900 welds or more per hour were placed in the high criterion group; all others were placed in the low criterion group.

Table IV shows the relationship between test norms consisting of Aptitudes K, F, and M with critical scores of 80, 85 and 75, respectively and the dichotomized criterion for *Spot-Welder Feeder*. Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

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TABLE IV

Relationship between Test Norms Consisting of Aptitudes K, F and M with Critical Scores of 80, 85 and 75, Respectively and the Criterion for Spot-Welder Feeder (Welding) 819.886

N = 50

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	7	26	33
Poor Workers	10	7	17
Total	17	33	50

$r_{tet} = .58$ $\quad X^2 = 5.496$

$\sigma_{r_{tet}} = .24$ $\quad P/2 = .01$

The data in the above table indicate a significant relationship between the test norms and the criterion for this sample.

VIII. Conclusions

On the basis of mean scores, correlations with the criterion, job analysis data and their combined selective efficiency, Aptitudes K, F and M with minimum scores of 80, 85 and 75 respectively, are recommended as B-1002 norms for the occupation of Spot-Welder Feeder. The equivalent B-1001 norms consist of T-75, F-90 and M-75.

IX. Determination of Occupational Aptitude Pattern

When the specific test norms for an occupation include three aptitudes, only those occupational aptitude patterns which include the same three aptitudes with cutting scores that are within 10 points of the cutting scores established for the specific norms are considered for that occupation. The only one of the existing 22 occupational aptitude patterns which meets these criteria for this study is OAP-17, which consists of K-85, F-80 and M-80 for B-1002. The selective efficiency of OAP-17 for this sample was determined by means of the tetrachoric correlation technique. No significant relationship was obtained between OAP-17 and the criterion for this experimental sample. Therefore, none of the existing 22 occupational aptitude patterns is recommended for Spot-Welder Feeder. However, the data for this sample will be considered for future groupings of occupations in the development of new occupational aptitude patterns.