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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 and a personnel evaluation form are also included. (AG)

September 1968 United States Employment Service Technical Report S-281R

S-281R

Development of USES Aptitude Test Battery for Capacitor Winder

(elec. equip.) 726.884

U.S. DEPARTMENT OF LABOR
MANPOWER ADMINISTRATION

Technical Report on Development of USES Aptitude Test Battery

For . . . .

Capacitor Winder (elec. equip.) 726.884

S-281R

(Developed in Cooperation with the California,
Massachusetts and Wisconsin State Employment Service)

U. S. DEPARTMENT OF LABOR
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September 1968

FOREWORD

The United States Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 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, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination, predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

Charles E. Odell, Director
U.S. Employment Service

GATB Study #2670

DEVELOPMENT OF USES APTITUDE TEST BATTERY

FOR

Capacitor Winder (elec. equip.) 726.884-030
S-281R

This report describes research undertaken for the development of General Aptitude Test Battery (GATB) norms for the occupation of Capacitor Winder (elec. equip.) 726.884-030. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB Scores
N - Numerical Aptitude	80
Q - Clerical Perception	95
K - Motor Coordination	75

RESEARCH SUMMARY

Sample:

53 (52 female and 1 male) workers employed as Capacitor Winders in various companies in California, Massachusetts and Wisconsin.

Criterion:

Supervisory ratings

Design:

Concurrent (test and criterion data were collected at approximately the same time).

Minimum aptitude requirements were determined on the basis of a job analysis and statistical analyses of aptitude mean scores, standard deviations, aptitude-criterion correlations, and selective efficiencies.

Concurrent Validity:

Phi Coefficient = .34 ($P/2 < .01$)

Effectiveness of Norms:

Only 68% of the non-test-selected workers used for this study were good workers. If the workers had been test-selected with the S-281R norms, 82% would have been good workers. 32% of the non-test-selected workers used for this study were poor workers. If the workers had been test-selected with the S-281R norms, only 18% would have been poor workers. The effectiveness of the norms is shown graphically in Table 1.

TABLE 1

Effectiveness of Norms

	Without Tests	With Tests
Good Workers	68%	82%
Poor Workers	32%	18%

SAMPLE DESCRIPTION

Size: N=53

Occupational Status:

Employed workers

Work Setting:

Workers were employed at the following locations:

Company	Location
Hopkins Engineering Company	San Fernando, California
Cornell-Dublier	Venice, California
Sprague Electric Company	North Adams, Massachusetts
Wells Manufacturing Company	Fond du Lac, Wisconsin

Employer Selection Requirements:

Education: None except ability to speak, read and write English
Previous Experience: None required
Tests: None

Principal Activities

Each worker performs the majority of the tasks described in the job description in the Appendix. The trend is toward the operation of the semi-automatic machines rather than the conventional ones.

Minimum Experience

All workers in the sample had at least one month total job experience.

TABLE 2

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

	Mean	SD	Range	r
Age (years)	41.3	12.8	19-61	-.004
Education (years)	10.0	1.6	7-13	.064
Experience (months)	103.5	98.5	1-384	.075

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002B, were administered to this sample during October-December 1967.

CRITERION

The criterion data consisted of supervisory ratings of job proficiency made at approximately the same time as the test data were collected. Independent ratings were made by the workers' immediate supervisors with a two-week interval between ratings.

Rating Scale

An adaptation of the USES Descriptive Rating Scale, SP-21, was used. The scale (see Appendix) consists of seven items with five alternatives for each item. The alternatives indicate different degrees of job proficiency.

Reliability

The reliability coefficient between the two ratings is .95, indicating a significant relationship. Therefore, the final criterion consisted of the combined scores of the two sets of ratings.

Criterion Score Distribution

Possible Range:	14-70
Actual Range:	34-70
Mean:	51.9
Standard Deviation:	9.6

Criterion Dichotomy

The criterion distribution was dichotomized into low and high groups by placing 32% of the sample into the low group to correspond with the percentage of workers considered unsatisfactory or marginal. Workers in the high criterion group were designated as "good workers" and those in the low group as "poor workers." The criterion critical score is 47.

APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were considered for tryout in the norms on the basis of a qualitative analysis of the job duties involved and a statistical analysis of test and criterion data. Although Aptitudes K and M did not have a significant correlation with the criterion, they were considered for inclusion in the norms because the qualitative analysis indicated that these aptitudes were important for job duties and the sample had relatively high mean scores on these aptitudes. Tables 3, 4, and 5 show the results of the qualitative and statistical analyses.

TABLE 3

Qualitative Analysis
(Based on the job analysis, the aptitudes indicated appear to be important to the work performed)

Aptitude	Rationale
G-General Learning Ability	In learning correct sequence of job set-up and machine operation; in understanding job orders as to type and number of tape roles and the number of winds for each capacitor
K-Motor Coordination	In threading tape through rollers, inserting arbors into chuck and in placing tape on spindle
F-Finger Dexterity	Required in threading tape through rollers; in holding tape while applying glue on tape end; and in sealing tape end to capacitor with strip of scotch tape.
M-Manual Dexterity	Required in stopping arbor by braking handwheel with left hand; in placing rolls on machine, in engaging and disengaging arbor on semi-automatic machines; and in sliding and flipping cutter.

TABLE 4

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

G - General Learning Ability	91.8	14.2	66-128	.358**
V - Verbal Aptitude	94.6	13.5	74-135	.303*
N - Numerical Aptitude	89.2	14.5	65-120	.373**
S - Spatial Aptitude	93.4	16.9	61-137	.147
P - Form Perception	95.5	17.6	58-138	.132
Q - Clerical Perception	105.6	13.0	81-135	.393**
K - Motor Coordination	99.4	15.0	62-140	.151
F - Finger Dexterity	97.7	16.4	60-131	-.103
M - Manual Dexterity	102.5	19.5	54-149	.041

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

TABLE 5

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes								
	G	V	N	S	P	Q	K	F	M
Job Analysis Data									
Important	X						X	X	X
Irrelevant									
Relatively High Mean						X	X		X
Relatively Low Standard Dev.	X	X	X			X			
Significant Correlation with Criterion	X	X	X			X			
Aptitudes to be Considered for Trial Norms	G	V	N			Q	K		M

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of a comparison of the degree to which trial norms consisting of various combinations of Aptitudes G, V, N, Q, K and M at trial cutting scores were able to differentiate between the 68% of the sample considered good workers and the 32% of the sample considered poor workers. Trial cutting scores at five point intervals approximately one standard deviation below the mean are tried because this will eliminate about one-third of the sample with three-aptitude norms. For two-aptitude trial norms, minimum cutting scores slightly higher than one standard deviation below the mean will eliminate about one-third of the sample. For four-aptitude trial norms, minimum cutting scores slightly lower than one standard deviation below the mean will eliminate about one-third of the sample. The Phi Coefficient was used as a basis for comparing trial norms. The optimum differentiation for the occupation Capacitor Winder (elec. equip.) 726.884-030 was provided by norms of N-80, Q-95, and K-75. The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .34 (statistically significant at the .01 level).

TABLE 6

Concurrent Validity of Test Norms,
N-80, Q-95, K-75

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	9	27	36
Poor Workers	11	6	17
Total	20	33	53

Phi Coefficient (ϕ) = .34 Chi Square (X^2_y) = 6.1
Significance Level = $P/2 < .01$

DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study did not meet the requirements for incorporating the occupation studied into any of the existing 36 OAP's included in Section II of the Manual for the General Aptitude Test Battery. The data for this sample will be considered for future groupings in the development of new occupational aptitude patterns.

A-P-P-E-N-D-I-X

SP-21
Rev. 2/61

DESCRIPTIVE RATING SCALE
(For Aptitude Test Development Studies)

Score____

RATING SCALE FOR _____
D. O. T. Title and Code

Directions: Please read Form SP-20, "Suggestions to Raters", and then fill in the items listed below. In making your ratings, only one box should be checked for each question.

Name of Worker (print) _____
(Last) (First)

Sex: Male _____ Female _____

Company Job Title: _____

How often do you see this worker in a work situation?

☐ See him at work all the time.

☐ See him at work several times a day.

☐ See him at work several times a week.

☐ Seldom see him in work situation.

How long have you worked with him?

☐ Under one month.

☐ One to two months.

☐ Three to five months.

☐ Six months or more.

A. How much work can he get done? (Worker's ability to make efficient use of his time and to work at high speed.)

☐ 1. Capable of very low work output. Can perform only at an unsatisfactory pace.

☐ 2. Capable of low work output. Can perform at a slow pace.

☐ 3. Capable of fair work output. Can perform at an acceptable but not a fast pace.

☐ 4. Capable of high work output. Can perform at a fast pace.

☐ 5. Capable of very high work output. Can perform at an unusally fast pace.

B. How good is the quality of his work? (Worker's ability to do high-grade work which meets quality standards.)

☐ 1. Performance is inferior and almost never meets minimum quality standards.

☐ 2. The grade of his work could stand improvement. Performance is usually acceptable but somewhat inferior in quality.

☐ 3. Performance is acceptable but usually not superior in quality.

☐ 4. Performance is usually superior in quality.

☐ 5. Performance is almost always of the highest quality.

C. How accurate is he in his work? (Worker's ability to avoid making mistakes.)

☐ 1. Makes very many mistakes. Work needs constant checking.

☐ 2. Makes frequent mistakes. Work needs more checking than is desirable.

☐ 3. Makes mistakes occasionally. Work needs only normal checking.

☐ 4. Makes few mistakes. Work seldon needs checking.

☐ 5. Rarely makes a mistake. Work almost never needs checking.

D. How much does he know about his job? (Worker's understanding of the principles, equipment, materials and methods that have to do directly or indirectly with his work.)

☐ 1. Has very limited knowledge. Does not know enough to do his job adequately.

☐ 2. Has little knowledge. Knows enough to "get by".

☐ 3. Has moderate amount of knowledge. Knows enough to do fair work.

☐ 4. Has broad knowledge. Knows enough to do good work.

☐ 5. Has complete knowledge. Knows his job thoroughly.

E. How much aptitude or facility does he have for this kind of work? (Worker's adeptness or knack for performing his job easily and well.)

☐ 1. Has great difficulty doing his job. Not at all suited to this kind of work.

☐ 2. Usually has some difficulty doing his job. Not too well suited to this kind of work.

☐ 3. Does his job without too much difficulty. Fairly well suited to this kind of work.

☐ 4. Usually does his job without difficulty. Well suited to this kind of work.

☐ 5. Does his job with great ease. Exceptionally well suited for this kind of work.

F. How resourceful is he when something different comes up or something out of the ordinary occurs? (Worker's ability to apply what he already knows to a new situation.)

☐ 1. Almost never is able to figure out what to do. Needs help on even minor problems.

☐ 2. Often had difficulty handling new situations. Needs help on all but simple problems.

☐ 3. Sometimes knows what to do, sometimes doesn't. Can deal with problems that are not too complex.

☐ 4. Usually able to handle new situations. Needs help on only complex problems.

☐ 5. Practically always figures out what to do himself. Rarely needs help, even on complex problems.

G. Considering all the factors already rated, and only these factors, how acceptable is his work? (Worker's "all around" ability to do his job.)

☐ 1. Would be better off without him. Performance usually not acceptable.

☐ 2. Of limited value to the organization. Performance somewhat inferior.

☐ 3. A fairly proficient worker. Performance generally acceptable.

☐ 4. A valuable worker. Performance usually superior.

☐ 5. An unusually competent worker. Performance almost always top notch.

September 1968

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FACT SHEET

JOB TITLE: Capacitor Winder (elec. equip.) 726.884-030

JOB SUMMARY: Sets up and operates a conventional or semi-automatic machine which winds metallized paper and plastic film capacitors.

Work Performed: Conventional Machine: Determines from job order, type and number of tape rolls needed, and number of winds capacitor will require. Obtains appropriate number of tape rolls and arbors for specific type capacitor. Inserts arbor into chuck of machine and tightens nut on chuck with hex key to hold arbor in place. Places tape roll on spindle and tightens nut with fingers to secure tape roll on spindle. Threads tape through rollers with fingers. Takes tape ends with fingers and winds tape once around arbor. Manually sets winding meter to zero. Depresses foot pedal to rotate arbor and observes tension of tape for correct sizing of capacitor, watching meter for tape cut-off point. Releases foot pedal to reduce speed of rotating arbor when nearing tape cut-off point. Stops arbor at required number of winds by braking machine handwheel with left hand. Cuts tape with scissors at arbor; holds tape end with fingers and applies a dab of glue on tape end with small brush, or seals tape end to capacitor with strip of scotch tape. Depresses foot pedal of machine to rotate arbor and presses sealed end of capacitor with fingers to insure seal. Labels rotating capacitor with colored grease pencil. Releases foot pedal and stops machine. Pulls capacitor from arbor with fingers and drops capacitor into container. Repeats winding operation until job is completed. Initials and records on job order, number of capacitors assembled, and date completed. Cleans machine surfaces with cloth when necessary.

Semi-automatic Machine: Determines from job order, size, type, and number of tape rolls needed, and number of winds capacitor will require. Obtains appropriate number of tape rolls, track bar, and arbors. Manually sets dials on automatic meter of machine to number of winds required for each capacitor. Inserts arbors into chuck of machine and tightens nut with wrench. Places and secures track bar on machine. Runs each tape along track bar until tape ends extend a few inches beyond and above one arbor. Slides tape cutter over tape with right hand and presses cutter to cut tape. Flips cutter backwards to place tape end in center position. Slides tape cutter to right side of machine. Presses switch to start machine. Depresses foot pedal to rotate arbors and wind tape. Observes winding tape for tension and correct sizing of capacitor while arbors rotate until machine automatically stops at required number of winds. Slides tape cutter over arbors of machine and presses cutter to cut tape. Manually disengages arbors with small hand tools by sliding arbor handle away from center position. Flips arbor handle with hand tool to second arbor leaving completed capacitor exposed. Flips cutter backwards with right hand to place tape in center position; slides cutter to right side of machine. Engages arbor and inserts tape by pushing arbor handles into center position. Depresses foot pedal to rotate arbor. Seals exposed tape end to capacitor with dab of glue using small brush or strip of scotch tape. Labels rotating capacitor with colored grease pencil. Removes capacitor with fingers and drops capacitor into container. Repeats operation until job is completed. Initials and records on job order, number of capacitors assembled, and date completed. Cleans machine surfaces with cloth when necessary.

Effectiveness of Norms: Only 68% of the nontest-selected workers used for this study were good workers; if the workers had been test-selected with the S-281R norms, 82% would have been good workers. 32% of the nontest-selected workers used for this study were poor workers; if the workers had been test-selected with the S-281R norms only 18% would have been poor workers.

Applicability of S-281R Norms: The aptitude test battery is applicable to either the nventional or the semi-automatic machine jobs which include a combination of two or re of the duties described above.

GPO 864-984

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