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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 establised 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)

TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

CORE PLANE WIRER (electronics) 6-98.027

B-597 S-317

U. S. Employment Service
in Cooperation with
New York State Employment Service

October 1964

GATB # 2522

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

CORE PLANE WIRER (electronics) 6-98.027

B-597 S-317

Summary

The General Aptitude Test Battery, B-1002B, was administered to a final sample of 58 females employed as Core Plane Wirers 6-98.027 at the Ferroxcube Corporation of America, Saugerties, New York. The criterion consisting of supervisory ratings. On the basis of mean scores, standard deviations, correlations with the criterion, job analysis data and their combined selective efficiency, Aptitudes G-Intelligence, P-Form Perception, K-Motor Coordination and F-Finger Dexterity were selected for inclusion in the final test norms.

GATB Norms for Core Plane Wirer (electronics) 6-98.027, B-597. S-317

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
G	CB-1-H CB-1-I CB-1-J	80	G	Part 3 Part 4 Part 6	75
P	CB-1-A CB-1-L	75	P	Part 5 Part 7	75
T	CB-1-I	85	K	Part 8	90
F	CB-1-O CB-1-P	105	F	Part 11 Part 12	100

Effectiveness of Norms

The data in Table IV indicate that only 66 percent of the non-test-selected workers used for this study were good workers; if the workers had been test-selected with the above norms, 75 percent would have been good workers. 34 percent of the non-test-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms only 25 percent would have been poor workers.

TECHNICAL REPORT

I. Purpose

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 Core Plane Wirer 6-98.027.

II. Sample

The GATB, B-1002B, was administered to 58 female Core Plane Wirers employed by the Ferroxcube Corporation of America, Saugerties, New York. All workers included in the experimental sample had completed the in-service training required by the company and had a minimum of four months of experience. A formal, continuous training program is carried on by the company and involves each new wirer for a period of three to six months before standard performance is expected.

Workers included in the sample were employed on either of two shifts. Each shift is supervised by a foreman and a lead girl, the immediate supervisor. Both shifts perform identical tasks, so that work left incomplete at the end of one shift often may be completed by a member of the second shift. Approximately half of the members of each shift were represented in the total sample.

TABLE I

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

N = 50	M	σ	Range	r
Age (years)	29.6	9.2	19-51	-.075
Education (years)	10.9	1.8	7-17	.036
Experience (months)	12.4	7.0	4-39	-.058

III. Job Description

Job Title: Core Plane Wirer (electronics) 6-98.027

Job Summary: Wires electric memory planes by threading and weaving multiple, hairlike wires manually through rows of minute ferrite cores, and attaching wire ends to numerous terminal lugs with a wrapping tool.

Work Performed: Prepares to wire memory plane: Receives core matrix (Mat), frame, spools of wire, solder, needles, and work order, from supervisor. Loosens power arm and levels holding fixture. Fastens frame to fixture by inserting screws through holes in four corners of frame and tightening with small screwdriver. Places small pieces of adhesive tape on top corners to identify top of frame. Visually inspects mat for broken or missing cores and replaces them with small pointed tweezers. Trims excess paper from edges of mat with scissors and places mat in center of frame on flat surfact of fixture. Dresses unpointed end of needle with fine emory cloth and lays on asbestos block, holding it in place for soldering to wire with small piece of adhesive tape. Cuts off several feet of wire and tapes end to block alongside end of needle to make about a 1/8 inch lap. Rubs tip of small hatchet type soldering iron along wire lap to burn off polyurethane insulation. Touches fine wire-solder to iron and wipes point of iron repeatedly over joint in the direction of the needle point until solder adheres. Strips tapes from connected wire and needle, and smoothes soldered joint by rubbing fold of fine emery cloth back and forth over joint.

Installs Y wires: Aligns mat in center of frame and threads guide wire through the outside rows of cores on all four sides to hold mat in centered position. Breaks off each wire after threading, leaving a three or four inch tail wire, and handwraps it one turn around projecting lug at each frame corner; makes the eight ends of the four guide wires more secure by wrapping each one five turns around terminal lug with a wrapping tool. Loosens power arm, rotates frame counter clockwise 1/4 turn, tilting it so that cores can be best seen, and moves handlever to tighten fixture and hold workpiece rigidly in desired position.

Starts threading Y wires by carefully pushing needle, with wire attached, through cores in first row at top of mat, using point of orange stick to help guide point of needle, or to tip or turn cores as needed. Draws 10 to 15 inches of wire out of the row of cores and places needle on one of the magnetic needle holders located left and right of wiring fixture. Pulls the excess wire straight through row of cores, allowing the wire to slide between the tips of the thumb and forefinger of the hand on the trailing wire on the entrance side of the row, to feel for kinks as the wire is drawn through them.

After nearly the full length of wire has been pulled through, handwraps one full turn around the rows terminal lug, leaving a three-inch tail of wire for subsequent permanent wrapping. Pulls threaded wire tight and handwraps

a full turn around terminal at opposite end of row. Cuts off wire by quickly twisting it between the thumb nails, leaving a three-inch tail-wire as before.

Continues to thread wires in the same manner, successively through alternate rows and in alternate directions, until about 10 rows of cores are wired or wire on needle is used. Wraps tail wires on right side of frame by pushing open end of wrapping tool over terminal; pulls wire out firmly and slips it under spring of tool; holds knurled support barrel with fingers of left hand and turns handle of tool with thumb and fingers of right hand with as nearly a constant motion as possible until six full turns are made. Snaps off wire by holding it as tool handle is turned. Continues until all wires on right side of frame are wrapped. Loosens fixture and turns plane 180 degrees so that other hand-wrapped end is on right-hand side and wraps tail wires on respective terminal lug with wrapping tool as before.

Repeats threading and wrapping additional sets of alternate rows of cores, and when bottom-most row is reached, returns to top of plane and wires remaining alternate rows in same manner.

Removes temporary guide wires from top and bottom rows, threads and wraps permanent wires into place. Examines all wrapped lugs carefully for evenness and neatness.

Installs X wires: Loosens and raises frame from fixture, and inserts card-board shim under mat to raise cores and reduce the possibility of threading X wires under rather than on top of Y wires.

Solders needle to fresh lengths of wire as needed, and threads and wraps off X wires through same cores but in rows at right angles to Y wired cores, using the same procedure as described for Y wiring, using care to see that X wires rest on top of Y wires, previously installed.

Performs inhibit wiring: Positions frame with identifying number at top. Examines configuration sketch in manufacturing instructions to note required direction of wiring and which lugs are to be wrapped. Unreels from spool, several feet of wire as specified, for one-half of inhibit configuration, leaving remainder of wire attached to spool. Solders needle to free end of wire.

Counts up from bottom of frame, one-half of the rows and begins continuous wiring in alternate direction, row by row, using both hands, and being sure that the inhibit wire does not dip under the X and Y lines. Makes well rounded uniform loops in wire at end of each row by pulling on the wire and using point of orange stick to aid in forming loops. After threading last row, cuts wire and wraps on specified terminal lug.

Measures from spool enough wire to complete second half of frame, and solders on needle. Threads wire in alternate directions as before, until

all remaining rows are completed; weaves unused wire over and under every eight X wires along the edge of frame and wraps prescribed number of turns on terminal lug with wrapping tool.

Installs sense wires in quadrants of plane: Loosens frame and inserts manilla shim to further elevate mat and guard against dipping under previous wires. Measures off prescribed length of wire and solders to needle. Starts wiring first quadrant from the farthest left sense pin at bottom of frame, by threading diagonal row from bottom left closed core, through upper right core position. Makes loop to the right and down through adjacent diagonal row of like-oriented cores. Repeats same method of wiring alternate rows until quadrant is completely wired. Secures wire tail to terminal lug with wrapping tool. Wires the three remaining quadrants in similar manner, repositioning plane and consulting wiring sketches and directions as necessary.

Performs incidental duties: Records plane identification number, date, wiring operations performed and amount of time; notifies supervisor and receives next wiring assignment. Cleans up work station at end of shift, disposing of pieces of wire and bits of solder.

IV. Experimental Battery

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

V. Criterion

The criterion consisted of separate supervisory rank-order ratings and reratings on each of five aspects of the job. Therefore, ten sets of rank-order ratings were made, five sets in the initial rating and five sets in the rerating. Each set of ratings was converted to standard scores and a summation was made of the five standard scores in the original rating and in the rerating, respectively. Since a correlation of .87 was obtained between these two distributions of standard scores, the two distributions were combined to obtain the final distribution of criterion scores.

VI. Qualitative and Quantitative Analyses

A. Qualitative Analysis

On the basis of the job analysis data, the following aptitudes were rated "important" for success in this occupation:

Intelligence (G) - required to understand wiring assignments; to interpret wiring sketches and understand and follow plane-wiring procedures.

Spatial Aptitude (S) - required to examine configuration sketch in manufacturing instruction, to note required direction of wiring and to visualize patterns in wiring forms.

Form Perception (P) - required to visually inspect mat for broken or missing cores and to replace cores.

Motor Coordination (K) - required for deftness and coordination in manipulating needles, fine wire and cores.

Finger Dexterity (F) - required to manipulate needles, handle extremely fine wire, thread needles, and reorient cores by turning or tipping them with pointed stick.

B. Quantitative Analysis:

TABLE II

Means (M), Standard Deviations (σ), and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N = 50

Aptitudes	M	σ	r
G-Intelligence	93.1	14.8	.278*
V-Verbal Aptitude	99.4	12.8	.277*
N-Numerical Aptitude	90.4	16.1	.239
S-Spatial Aptitude	95.3	15.4	.103
P-Form Perception	106.8	19.3	.123
Q-Clerical Perception	103.0	13.1	.260*
K-Motor Coordination	107.7	13.9	-.139
F-Finger Dexterity	107.2	18.0	.162
M-Manual Dexterity	95.4	15.4	.072

*Significant at the .05 level

C. Selection of Test Norms:

TABLE III

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	X	
Irrelevant									
Relatively High Mean					X		X	X	
Relatively Low Sigma	X	X				X	X		
Significant Correlation with Criterion	X	X				X			
Aptitudes to be Considered for Trial Norms	G	V			P	Q	K	F	

Trial norms consisting of various combinations of Aptitudes G, V, P, Q, K and F with appropriate cutting scores were evaluated against the criterion by means of the Phi Coefficient technique. A comparison of the results showed that B-1002 norms consisting of G-75, P-75, K-90 and F-100 had the best selective efficiency.

VII. Validity of Norms

The validity of the norms was determined by computing a Phi Coefficient between the test norms and the criterion and applying the Chi Square test. The criterion was dichotomized by placing 34 percent of the sample in the low criterion group because this percent was considered to be the unsatisfactory or marginal workers.

Table IV shows the relationship between test norms consisting of Aptitudes G, P, K and F with critical scores of 75, 75, 90 and 100, respectively, and the dichotomized criterion for Core Plane Wirer 6-98.027. Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

TABLE IV

Validity of Norms for
Core Plane Wirer 6-98.027
G-75, P-75, K-90, F-100

N = 58	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	11	27	38
Poor Workers	11	9	20
Total	22	36	58
		Phi Coefficient =	.26
		X^2 =	3.770
		P/2	.05

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

VIII. Conclusions

On the basis of the results of this study, Aptitudes G, P, K and F with minimum scores of 75, 75, 90 and 100, respectively, have been established as B-1002 norms for Core Plane Wirer 6-98.027. The equivalent B-1001 norms consist of G-80, P-75, T-85 and F-105.

IX. Determination of Occupational Aptitude Pattern

The data for this study did not meet the requirements for incorporating the occupation studied into the January 1962 edition of Section II of the Guide to the Use of the General Aptitude Test Battery. The data for this sample will be considered for future groupings of occupations in the development of new occupational aptitude patterns.