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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)

TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

AUTOCLAVE OPERATOR (chem.) 4-52.711

B-527 S-250

U. S. Employment Service
in Cooperation with
Pennsylvania State Employment Service

November 1962

GATB #2420
January 1962

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

AUTOCLAVE OPERATOR 4-52.711

B-527

SUMMARY

The General Aptitude Test Battery, B-1002A, was administered to a final sample of 52 men employed as Autoclave Operator 4-52.711 by the Kopper Company, Inc., Lock Haven, Pennsylvania. The criterion consisted 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, N-Numerical, and S-Spatial were selected for inclusion in the final test norms.

GATB Norms for Autoclave Operator 4-52.711, B-527

Table I shows, for B-1001 and B-1002, the minimum acceptable score for each aptitude included in the test norms for Autoclave Operator 4-52.711.

TABLE I

Minimum Acceptable Scores on B-1001 and B-1002 for B-527

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	75	G	Part 3 Part 4 Part 6	70
N	CB-1- D CB-1- I	80	N	Part 2 Part 6	75
S	CB-1- F CB-1- H	95	S	Part 3	90

Effectiveness of Norms

The data in Table V indicate that 12 of the 22 poor workers, or 55 percent of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 55 percent of the poor workers would not have been hired if the recommended test norms had been used in the selection process. Moreover, 21 of the 31 workers who made qualifying test scores, or 68 percent, were good 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 Autoclave Operator 4-52.711.

II. Sample

The GATB, B-1002A, was administered during the period June 1961 to January 1962 to 52 men employed as Autoclave Operator 4-52.711 at the Koppers Company, Inc., Lock Haven, Pennsylvania. All workers in the sample are considered experienced workers. One worker has one month experience, however, the raters considered him a qualified worker. Inexperienced workers are trained for 40 days; their in-plant training consists of explanation, demonstration and observing an experienced worker. Training in reading process sheets is stressed. An eighth grade education is considered the minimum scholastic requirement for employment.

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

N = 52	M	σ	Range	r
Age (years)	34.0	8.1	21-54	.043
Education (years)	10.2	1.6	6-12	.246
Experience (months)	66.6	49.4	1-192	.271

There are no significant correlations between age, education, and experience with the criterion. The data in Table II indicate that the sample is suitable for test development purposes with respect to age, education, and experience.

III. Job Description

Job Title: Autoclave Operator (chem.) 4-52.711

Job Summary: Produces dyestuff by charging an autoclave, controlling reaction by changing or maintaining temperature as specified by Process Sheet, agitating mechanically, transferring to other vessels by gravity, pumping, pressure or vacuum, filtering to separate dyestuff from liquid, and taking samples for laboratory analysis.

Work Performed: Prepares to charge kettle: Reads Shop Orders, Process Sheet or Night Orders, or remembers from having performed the same reaction repeatedly and secures ingredients in drums from stock or pipes in, weighing drums on scales and subtracting tare from gross to find net contents. Reads labels, stencils, and color codes to make sure chemicals are identified as the ones required. Computes by arithmetic the quantities required in proportions specified by process sheet and calculates amount of ventilation required. Observes thermometer to determine kettle temperature.

Charges kettle: Installs manhead on kettle by making sure gasket is in place, carefully placing manhead over opening, and tightening clamp nuts alternately on opposite sides with wrench so as to avoid strains which would crack glassliner. Sucks liquid chemicals into kettle by operating valve of vacuum line after syphon charging line has been attached to drum, or sucks liquid up into egg for later transfer to kettle, observing sight glass on egg to determine level to which it is filled. Screws fittings into drums after removing plugs with wrench, inserts syphon hose into opening when liquid is to be run into open manhead, moving slowly enough to avoid spattering. Removes manhead by loosening clamp nuts and lifting off to provide opening for pouring dry chemicals, opens vent valve. Starts agitator by throwing switch, observes whether motor starts, immediately moves switch to stop position if agitator does not start and reports problem to building supervisor. Charges dry materials through manhead opening, using specified protective equipment such as respirator and goggles, etc. Cools overheating mixtures by pulling ice buggy along rails and running chip ice into kettle, or by cooling with cold water on jacket. Replaces manhead.

Controls reaction: Opens valve to supply cooling water to Reflux Condenser and opens steam or Dwotherm valve to heat kettle. Heats or cools carefully at the rate specified for the process, as indicated in the process sheet, by operating valves and observing mercury and recording thermometers, using a knowledge of the heat retaining and dissipating characteristics of the particular kettle and the reaction performed. Observes flow of condensate in sight glass of Reflux Condenser and notes temperature of kettle and appearance of condensate, using judgment to avoid identifying a False Reflux as a True Reflux so as to avoid reduced yield or off color. Cools kettle at time and rate specified. Observes thermometer to make sure temperature is low enough, observes pressure in gauge, and opens manhead.

Dips sample: Samples batch by lowering glass bottle into open manhead for sample.

Transfers charge to other vessels by opening steam valve at base of kettle to clear line; opens valve to drop charge to vessel below or attaches suction line to blow leg and sucks out charge to other vessel, making sure he knows where charge is going by going to floor below and checking valves and that other vessel is ready to receive batch before operating valve. Starts agitator and opens valve.

Filters out color: Operates valves to supply color and liquor to Filter Press. Washes with hot or cold water or solvents until filtrate is free of undesirable chemicals, and blows dry by forcing air through from compressed air line. Opens filter press or supervises others doing it by unfastening clamps and shovels cake of color into buggy for transport to drying oven.

Keeps record: Posts time, action taken and temperature to kettle sheet to provide assurance that process sheet is followed and information to aid in determining reason for any failure in process. May keep records of condition of accessory equipment such as ice machine by taking hourly readings of compressor head temperature, ammonia pressure, oil pressure. Reads thermostat of Dwotherm boiler and readjusts to secure required temperature of heat exchanging fluid.

IV. Experimental Battery

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

V. Criterion

The criterion consisted of supervisory ratings based on the Descriptive Rating Scale, Form SP-21. The rating scale consists of nine items covering different aspects of job performance with five alternatives for each item. Weights of one through five, indicating the degree of job performance attained, were assigned to each alternative. Two sets of ratings were obtained for the sample. One set of ratings was prepared by the Production Supervisor on January 13, 1962, and the other set of ratings was prepared by the Personnel Supervisor on this date. A correlation coefficient of .970 was obtained between these sets of ratings. Therefore, the final criterion consisted of the sum of both ratings for the individuals in the sample. The final criterion scores had a range of 38-90, a mean of 63.808, and a standard deviation of 10.196.

VI. Qualitative and Quantitative Analyses

A. Qualitative Analysis:

The job analysis indicated that the following aptitudes measured by the GATB appear to be important for this occupation:

Intelligence (G) - required in making judgment regarding valve adjustments for proper heating and cooling, in directing activities of helpers, and in learning to use a variety of equipment.

Numerical Aptitude (N) - required in computing percentages and proportions. Must compute arithmetically the quantities required in proportions specified by process sheet and calculate amount of ventilation required; this process is critical because a wrong measure may cause an explosion.

Spatial Aptitude (S) - required in visualizing piping layout nearby and at locations on other floors in order to determine effect of pressure or vacuum on materials that are not visible.

Clerical Perception (Q) - required in keeping records regarding time, action taken, and temperature readings on kettle sheet in order to verify process sheet; in reading and recording hourly readings of compressor lead temperature, ammonia pressures, etc; in reading process instructions; in reading labels of chemicals to avoid the possibility of costly and dangerous errors.

Manual Dexterity (M) - required in handling valves, wrenches, manheads, nuts, fittings and containers of chemicals; valves must be "cracked" skillfully to apply the right amount of pressure or vacuum to move fluids properly.

On the basis of the job analysis data, none of the aptitudes were considered "irrelevant" for performing the duties of this job.

B. Quantitative Analysis:

TABLE III

Means (M), Standard Deviations (σ), and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N = 52

Aptitudes	M	σ	r
G-Intelligence	95.1	16.6	.126
V-Verbal Aptitude	90.7	14.9	.084
N-Numerical Aptitude	94.5	15.9	.044
S-Spatial Aptitude	97.2	19.1	.225
P-Form Perception	92.5	15.4	.152
Q-Clerical Perception	93.1	12.7	.162
K-Motor Coordination	91.2	16.9	.130
F-Finger Dexterity	91.8	18.4	.135
M-Manual Dexterity	93.3	17.4	-.015

C. Selection of Test Norms:

TABLE IV

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			
Significant Correlation with Criterion									
Aptitudes to be Considered for Trial Norms	G		N	S		Q			

Trial norms consisting of various combinations of Aptitudes G,N, S and Q 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-70, N-75 and S-90 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 22 of the 52 workers, or 42 percent of the sample, in the low criterion group; a critical criterion score of 63 was used. These workers were considered to be the unsatisfactory or marginal performers.

Table V shows the relationship between test norms consisting of Aptitudes G, N and S with critical scores of 70, 75 and 90, respectively, and the dichotomized criterion for Autoclave Operator 4-52.711. Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

TABLE V

Validity of Test Norms for Autoclave Operator 4-52.711
(G-70, N-75, S-90)

N = 52

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	9	21	30
Poor Workers	12	10	22
Total	21	31	52

Phi Coefficient = .247
χ^2 = 3.172
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, N and S with minimum scores of 70, 75 and 90, respectively, have been established as B-1002 norms for the occupation of Autoclave Operator 4-52.711. The equivalent B-1001 norms consist of G-75, N-80 and S-95.

IX. Determination of Occupational Aptitude Pattern

The specific norms established for this study did not meet the requirements for allocation to any of the existing 35 occupational aptitude patterns (Revised 10/61). The data for this sample will be considered for future groupings of occupations in the development of new occupational aptitude patterns.