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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)

December 1970

U.S. Training and Employment Service Technical Report S-439R

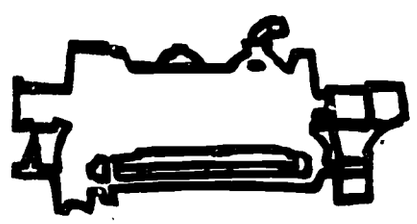
Development of USTES

APTITUDE TEST BATTERY FOR

CANNERY MECHANIC

(can. & preserv.)
638.281

U.S. DEPARTMENT OF LABOR
Manpower Administration



Technical Report on Development of USTES Aptitude Test Battery For . . .

Cannery Mechanic (can. & preserv.) 638.281-022

S-439R

(Developed in Cooperation with the
California State Employment Service)

U. S. Department of Labor
Manpower Administration

December 1970

FOREWORD

The United States Training and 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 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 similiar. The GATB norms described in this report are appropriate for use only for jobs with content similiar to that shown in the job description included in this report.

GATB Study # 2806

DEVELOPMENT OF USTES APTITUDE TEST BATTERY

for

Cannery Mechanic (can. & preserv.) 638.281-022

S-439R

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Cannery Mechanic (can. & preserv.) 638.281-022. The following norms were established:

GATB Aptitudes	Minimum Acceptable GATB Scores
S - Spatial Aptitude	85
P - Form Perception	70
M - Manual Dexterity	90

RESEARCH SUMMARY

Sample:

55 male workers employed as Cannery Mechanics by various food processing plants throughout northern California. Eight of the workers were Spanish American and one was Oriental. The remainder of the sample was composed of nonminority group members.

Criterion:

Supervisory ratings.

Design:

Concurrent (test and criterion data were collected at approximately the same time). Minimum aptitude requirements were determined by a job analysis and statistical analyses of aptitude mean scores, standard deviations, aptitude-criterion correlations, and selective efficiencies.

Concurrent Validity:

Phi Coefficient (ϕ) = .30 (P/2 is less than .025)

Effectiveness of Norms:

Only 65% of the non-test-selected workers were considered to be satisfactory or "good workers"; if these workers had been test-selected with S-439R norms, 80% would have been "good workers". 35% of the non-test-selected workers were considered to be marginal or "poor workers"; if these workers had been test-selected with S-439R norms, only 20% would have been "poor workers". These data are illustrated graphically in Table 1 below:

TABLE 1

Effectiveness of Norms

	Without Tests	With Tests
Good Workers	65%	80%
Poor Workers	35%	20%

SAMPLE DESCRIPTION

Size:

N = 55

Occupational Status:

Employed Workers

Work Setting:

Workers were employed as Cannery Mechanics in 11 different plants in northern California

Selection Requirements:

Education: Read, write, and speak English.

Experience: Production workers may bid on job openings as trainee mechanics, otherwise experienced mechanics are hired from outside the plant.

Tests: None.

Other: Interview and physical examination.

Principal Activities:

The workers' job duties are comparable to those in the job description included in the appendix.

Minimum Experience:

All workers had at least one year of direct experience as a Cannery Mechanic.

TABLE 2

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

N = 55		Mean	SD	Range	r
Age	(years)	43.2	8.2	26 - 56	.07
Education	(years)	10.0	2.2	4 - 14	.13
Experience	(months)	135.3	78.5	12 - 672	.23

N = 51 for Experience factor only.

EXPERIMENTAL TEST BATTERY

All 12 tests of the GATB, B-1002B with NCS answer sheets, were administered to the sample during the period of October 1967 through June 1969.

CRITERION

Criterion data consisted of dual supervisory ratings of job proficiency by the immediate supervisor. Initial ratings were obtained at the time of testing; second ratings were obtained at least two weeks later.

Rating Scale:

A modified Form SP-21, Descriptive Rating Scale, was developed to include the job performance factors considered to be of significant importance by various cannery maintenance supervisors (see appendix).

Reliability:

The correlation between the two ratings was .86, since this was considered satisfactory, the two ratings were combined. The final criterion consisted of the sum of the two ratings.

Distribution of Criterion Scores:

Possible Range:	18 - 90
Actual Range:	39 - 85
Mean:	60.6
Standard Deviation:	10.2

Dichotomization of Criterion Scores:

The criterion was dichotomized into high and low groups by placing 35% of the sample in the low criterion group. This corresponds with the approximate percentage of workers that various supervisory personnel considered to be marginal or "poor workers". Workers in the high group were designated as "good workers". The critical criterion score is 56.

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 and a statistical analysis of test and criterion data. Aptitudes G and K which do not have a high correlation with the criterion were considered for inclusion in the trial norms because the qualitative analysis indicated these aptitudes were important to the job duties and the sample had relatively low standard deviations on these aptitudes. Aptitude F was considered for inclusion in the final norms because the qualitative analysis indicated that it was of critical importance to job success. Tables 3, 4, and 5 show the results of the qualitative and statistical analyses of the data.

TABLE 3

Qualitative Analysis

(Based on job analysis data, the following aptitudes appear to be of significant importance to successful job performance).

Aptitude	Rationale
G - General Learning Ability	Necessary to "catch on" to instructions and to mechanical principles. Used to determine nature of malfunctions in machinery and to exercise judgment in selecting best method of making repairs.
S - Spatial Aptitude	Necessary to visualize the operation of mechanical parts; to read blueprints; layout sheet metal parts, and to install new machines.
P - Form Perception	Necessary to perceive details in machine parts during disassembly and repair. Must perceive extent of wear visually.
K - Motor Coordination	Necessary to coordinate hand and finger movements with visual stimuli during various mechanical repair activities, such as assembling and disassembling parts, welding, and using various handtools.
F - Finger Dexterity	Necessary to manipulate small parts and tools rapidly and accurately while making repairs. This is considered to be of critical importance.
M - Manual Dexterity	Necessary to move handtools and parts rapidly and accurately while making repairs.

TABLE 4

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

Aptitudes	Mean	S.D.	Range	r
G - General Learning Ability	91.3	14.7	59-119	.262
V - Verbal Aptitude	89.5	12.5	68-125	.108
N - Numerical Aptitude	85.7	16.4	44-113	.158
S - Spatial Aptitude	103.3	18.0	68-147	.358**
P - Form Perception	92.2	19.3	54-143	.450**
Q - Clerical Perception	98.9	13.8	69-139	.318*
K - Motor Coordination	91.0	14.2	60-115	.144
F - Finger Dexterity	89.8	18.5	41-119	.212
M - Manual Dexterity	97.8	17.3	59-156	.318*

* 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	X*	X
Irrelevant									
Relatively High Mean				X		X			X
Relatively Low Standard Deviation	X	X				X	X		
Significant Correlation with Criterion				X	X	X			X
Aptitudes to be Considered for Trial Norms	G			S	P	Q	K	F*	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 G, S, P, Q, K, F, and M attrial cutting scores were able to differentiate between the 65% of the sample considered good workers and the 35% 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 of Cannery Mechanic (can. & preserv.) 638.281-022 was provided by norms of S-85, P-70 and M-90. The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .30 (statistically significant at the .025 level.)

Table 6

Concurrent Validity of Test Norms, S-85, P-70, M-90

	Nonqualifying Test Scores	Qualifying Test Scores	Total
Good Workers	12	24	36
Poor Workers	13	6	19
Total	25	30	55

Phi Coefficient (ϕ) = .30 Chi Square (X^2_y) = 4.8

Significance Level = $P/2 < .025$

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 62 OAP's included in the 1970 edition of Section II of the Manual for 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.

MAINTENANCE MECHANIC (can. & preserv.) 638.281

SP-20
(Modified 9-67)

SUGGESTIONS TO RATERS

We are asking your assistance in this project since you know how well your men perform their jobs. Your ratings will serve as the "yardstick" to relate job performance with test scores. It is therefore vital to obtain a true picture of each mechanic's ability to perform his job. Should you have any questions, discuss them with the testing technician.

Your ratings will be strictly confidential; they will not be shown to the workers, the union, or management. Since the workers will not be affected by your ratings in any way, feel free to give an entirely objective rating of job performance.

Our tests will only measure a person's aptitudes (specificetypes of talents) for a job. Therefore, you must exclude all such personality factors as mannerisms, temperament, likeability, dependability, willingness to work on difficult jobs, etc. Likewise you must exclude other influencing factors, such as experience, age, education and leadership qualities,ssince they would distort the results. We realize that some of these factors may be important, but please make a conscious effort to rate the Mechanic only on the specific factors described on the rating sheet.

In order to simplify decisions, group your men together and compare them with all other Mechanics you have known who did similar work. Then consider how each man compares with all of the others as you go down the rating sheet, factor by factor. Remember that we all have "good days" and "bad days"; therefore consider each man's performance over a long period of time.

Your assistance in this project is appreciated.

SP-21 (Modified 10-13-67)

DESCRIPTIVE RATING SCALE
(For Aptitude Test Development Studies)
Maintenance Mechanics (can. & preserv.) 638.281

FOR OFFICE USE ONLY
SCORE_____
RATING NO. 1___ 2___

Worker's Name_____ Rater's Name_____ Title_____

Company_____ Location_____ Date_____

How long have you observed his work?
( ) Less than six months
( ) Six months to one year
( ) One to two years
( ) Two to four years
( ) Over four years

How often do you see him at work?
( ) All the time
( ) Several times a day
( ) Several times a week
( ) Seldom

1. QUALITY OF WORK: Ability to meet required standards; thoroughness; accuracy; jobs seldom need to be reworked.
( ) Unsatisfactory
( ) Below average
( ) Average
( ) Above average
( ) Outstanding

2. WORKING SPEED: Amount of work done; can and does hurry when necessary; gets the job done within time limitations.
( ) Unsatisfactory
( ) Below average
( ) Average
( ) Above average
( ) Outstanding

3. JOB KNOWLEDGE: Knows mechanical principles; manufacturers' specifications and ordering procedures; various repair procedures; man-hour requirements for various jobs.
( ) Unsatisfactory
( ) Below average
( ) Average
( ) Above average
( ) Outstanding

4. VERSATILITY: Can be used in a wide variety of job situations throughout the entire plant; an all-around mechanic; can improvise to meet the situation.
( ) Unsatisfactory
( ) Below average
( ) Average
( ) Above average
( ) Outstanding

5. DIAGNOSING MALFUNCTIONS: Trouble-shooting malfunctioning machines; rapidly determines what is wrong and how to correct it; knows where to get technical information in a hurry; knows how to use various types of test equipment.
( ) Unsatisfactory
( ) Below average
( ) Average
( ) Above average
( ) Outstanding

6. LEARNING SPEED: Understands instructions without having them repeated; applies his past experience to new and usual job situatio can work on complex new equipment with a minimum of training.
( ) Unsatisfactory
( ) Below average
( ) Average
( ) Above average
( ) Outstanding

7. ALERTNESS: Can detect potential machine malfunctions before they happen; detects safety hazards; devises better methods for doing a job or for improving a machine.
( ) Unsatisfactory
( ) Below average
( ) Average
( ) Above average
( ) Outstanding

8. APTITUDE: Well suited for the job; performs his job well with a minimum of effort; has the knack for getting the job done smoothly and properly.
( ) Unsatisfactory
( ) Below average
( ) Average
( ) Above average
( ) Outstanding

9. OVERALL RATING: Based only on the preceding factors, what do you think of his overall job performance? If you went to work elsewhere, and he applied for a job there, how would you recommend him?
( ) Unsatisfactory
( ) Below average
( ) Average
( ) Above average

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FACT SHEET

Job Title: Cannery Mechanic (can. & preserv.) 638.281-022

Job Summary:

Repairs, overhauls, installs, and modifies food processing machinery and related equipment, such as peach pitters, pear peelers, tomato choppers, spinach blanchers, can fillers, cookers, frozen food carton wrapping machines, conveyor systems, and pumps, using handtools and such repair shop equipment as gas and arc welding apparatus, sheet metal brake, and grinders.

Work Performed:

1. Repairs machinery and equipment: Determines nature of malfunction by such techniques as observing mechanical operations, listening for unusual operating noises, or examining processed items and decides upon most expedient method of repair. Dismantles unit as necessary to gain access to malfunctioning components, using such handtools as wrenches, screwdrivers, and hammers. Repairs, replaces, or fabricates parts as necessary to minimize work stoppages. Reassembles and test operates unit to insure that performance conforms to prescribed standards.

2. Overhauls machinery and equipment between seasonal operations: Examines machinery and equipment, prior to disassembly, to estimate the amount of work required, and to compile a listing of items needed during overhaul, using stock catalogues and applying experience acquired from previous overhauls. Completely disassembles unit to facilitate examining each part, and cleans parts by such processes as washing in solvents, or sandblasting. Inspects parts to detect evidence of damage or wear, using such aids as magnifying glass, micrometers, or special gages. Depending upon circumstances, replaces damaged or worn parts from stocks, or repairs or fabricates parts, using handtools and such shop equipment as lathe, drill press, arbor press, welding apparatus, and grinders. Reassembles unit in accordance with manufacturer's specifications. Repaints exterior surfaces as needed to prevent rust, and to enhance appearance, using brush or spraygun. Lubricates unit with specified products, using oil can or grease gun. Test operates unit.

3. Installs new machinery and equipment: Confers with supervisor, reviews installation plans, and reviews blueprints and manufacturer's manual to determine assignment in project. Prepares installation site for new machine and equipment by performing such tasks as removing old machinery, devising and fabricating new machine mounts, and reinforcing existing structures to support the new machinery and equipment. Moves new machine into position by employing such techniques as carrying on a forklift, hoisting, or dragging on skids. Mounts and alines machine in specified position, using handtools and spirit level. May connect machine's electrical wiring to plant circuitry. When flume system is used to carry raw foods to machine: Lays out sheet metal parts for connecting machine with existing flume channels by applying knowledge of sheet metal working techniques; cuts and forms sheet metal parts to fit,

using metal cutting shears and sheet metal brake; welds structure in place; and connects water supply and drain pipes to plant's plumbing system. When conveyor system is used to carry food to or from machines: Saws structural members to size; welds and/or bolts sections together; bolts rollers in place or threads conveyor belt through structure and joins to existing system, using conveyor belt splicer. When cable driven can conveyor systems are used, draws cable through system and splices cables together, using cable splicing tools. Test operates new machine and related systems.

4. Modifies existing machinery and equipment, as instructed, to obtain such objectives as improved safety, higher production, or reduced operating costs: Lay-out and fabricates parts needed for project, using handtools and shop equipment, such as sheet metal brake and welding apparatus, or requisitions standard parts. Dismantles unit as needed, installs modification assembly, and reassembles unit. Test operates and readjusts mechanism as needed to obtain desired results.

5. Miscellaneous duties: May perform such other duties as crating and uncrating machinery, painting plant and office areas, repairing vehicular equipment, and supervising seasonal production workers.

Effectiveness of Norms:

Only 65% of the non-test-selected workers were considered to be satisfactory or "good workers"; if these workers had been test-selected with S-439R norms, 80% would have been "good workers": 35% of the non-test-selected workers were considered to be marginal or "poor workers"; if these workers had been test-selected with these norms, only 20% would have been "poor workers".

Applicability of S-439R Norms:

This aptitude test battery is applicable to jobs which employ a majority of the duties described above.

GPO 904.786