



**Arizona Department of Education
Tom Horne, Superintendent of Public Instruction**

Arizona Career and Technical Education Curriculum Framework

Industrial Manufacturing July 2005

Division of Educational Services and Resources

For more information contact: Career and Technical Education Unit
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Arizona Department of Education
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Overview

Arizona Career and Technical Education

Vision: Ensure a dynamic workforce by fully developing every student's career and academic potential.

Mission: Prepare Arizona students for workforce success and continuous learning.

Adaptation/Adoption Curriculum Framework Process

The Arizona Department of Education, Career and Technical Education Division awarded an investigative research report analyzing present practices and format used in developing curriculum resources for the CTE program "frameworks." These findings (presented in May 2001) resulted in recommendations from the Arizona Career and Technical Education Advisory Committee as well as the CTE staff to design and implement a new Adaptation/Adoption Curriculum Process. The new strategies used in order to adapt/adopt program curriculum frameworks focus on:

- Identifying national industry skill standards
- Identifying industry recognized assessments/certificates (local and national)
- Developing a design team consisting of a significant majority of industry representation
- Reviewing other nationally recognized states' CTE program standards/frameworks
- Adapting/adopting existing program standards
- Soliciting industry and education representative feedback to validate all the components of the curriculum framework
- Increasing technical and academic rigor by applying higher order skills to program standards/measurement criteria
- Applying Arizona Academic Standards to program standards and identifying appropriate Performance Objectives that support improved academic attainment

Arizona CTE Delivery System

The Arizona CTE Delivery System includes the process of merging Level II and Level III competencies into Career Preparation standards. This program reflects the new delivery system.

Arizona's CTE **Career Preparation** programs use a continuous improvement model as the curriculum process is refined, resources are developed, educators provide feedback, and industry revalidates the curriculum framework components. Our goal is to utilize the Arizona CTE web site (<http://www.ade.az.gov/cte/careerpathways/>) and the Tech Prep web site (<http://www.aztechprep.org/>) to provide an avenue for upgrading and publicizing these frameworks. In today's fast paced, high-tech world, it is imperative to provide continuous response to industry needs in order to effectively prepare our students for success in their career choices.

For information, contact:

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PROGRAM: Industrial Manufacturing

**PROGRAM
CIP CODE:** 15.0600

DESCRIPTION: *The **Industrial Manufacturing** program is designed to prepare students to apply basic engineering principals and technical skills. Students will be prepared in the following instructional areas: manufacturing systems, materials processing, production planning and control, documentation, technical problem-solving, management information systems, predictive/preventive maintenance and automated manufacturing. In addition to the required technical skills, students will also develop leadership, advanced employability, critical thinking, applied academic and life management skills. The program utilizes a delivery system made up of three essential components: formal instruction, experiential education, leadership and personal development through the Career and Technical Student Organization, SkillsUSA.*

RECOMMENDED PROGRAM SEQUENCE OF COURSES:

**Career
Exploration
Grades
7-9** *The following course is recommended as part of a **Comprehensive Career and Technical Education (CTE Program)**:*

90.0000.10 ***Technological Foundations or Career Exploration:*** All students **should** complete, experience or attain these standards (competencies).

**Career
Preparation
Grades
10-12** *The following describes the recommended **Career Preparation courses developed from industry-validated skills for initial employment or continued related education. All the State-designated CTE INDUSTRIAL MANUFACTURING standards are addressed in this instructional sequence.***

15.0600.10 ***Fundamentals of Industrial Manufacturing:*** This course includes units of instruction in examining the use of electrical/electronic, mechanical, hydraulic, pneumatic, chemical, computer control and power systems used in manufacturing. Units also include measurement techniques and instruments, blueprint and technical drawing reading. Additional units include career planning, communications skills, work based learning experiences, business planning, teamwork,

safety, creative thinking and problem solving.

15.0600.20 **Applications of Industrial Manufacturing:** This course includes units for the application and operation of electrical/electronic, mechanical, hydraulic, pneumatic, chemical, automated manufacturing, measurement instruments and power systems used in manufacturing. Additional units provide the integration of basic engineering principles and technical skills in the manufacturing of a product.

One of the following Career Preparation options will be included as part of the instructional sequence for this program:

15.0600.30 **Metals Manufacturing Option A:** Course description is under development.

15.0600.40 **Plastics Manufacturing Option B:** Course description is under development.

15.0600.50 **Principles of Engineering Technology Option C:** Course description is under development.

-And program may elect to add-

15.0600.80 **Industrial Manufacturing-Cooperative Education:** This course utilizes cooperative education methodology to combine school based and supervised work-based learning experiences directly related to the standards identified for the **Industrial Manufacturing** program.

Contact Information:
Arizona Department of Education
State Supervisor for Industrial Technology
602-542-5423

Occupational Information Network (O*NET)

Standard Occupational Classification System (SOC)

<http://online.onetcenter.org>

The O*NET database includes information on skills, abilities, knowledge, work activities, and interests associated with occupations. This information can be used to facilitate career exploration, vocational counseling, and a variety of human resources functions, such as developing job orders and position descriptions and aligning training with current workplace needs. Information in O*NET is available for 900+ occupations. Each occupational title and code is based on the most current version (2005) of the Standard Occupational Classification system. The O*NET system is continually being updated.

O*NET is a unique, powerful source for continually updated occupational information and labor market research. By using a contemporary, interactive skills-based database and a common language to describe worker skills and attributes, O*NET coding structure has been aligned to the newly revised Standard Occupational Classification (SOC).

Industrial Manufacturing CIP No. 15.0600

O*NET SOC OCCUPATION TITLE	O*NET SOC CODE	**Job Zone (see end of section)
Industrial Production Managers	11-3051.00	4
Purchasing Managers	11-3061.00	4
Storage and Distribution Managers	11-3071.02	3
Chemical Engineers	17-2041.00	4
Electrical Engineers	17-2071.00	4
Electronics Engineers	17-2072.00	5
Industrial Safety and Health Engineers	17-2111.01	4
Product Safety Engineers	17-2111.03	5
Industrial Engineers	17-2112.00	4
Materials Engineers	17-2131.00	5
<i>Recognized Apprenticeship Specialties:</i>		
<i>Foundry Metallurgist</i>		
<i>Materials Engineer</i>		
Mechanical Engineers	17-2141.00	4
<i>Recognized Apprenticeship Specialties:</i>		
<i>Tool Designer</i>		
Electronics Engineering Technicians	17-3023.01	4
<i>Recognized Apprenticeship Specialties:</i>		
<i>Electronics Technician</i>		

Calibration and Instrumentation Technicians <i>Recognized Apprenticeship Specialties:</i> Electrical-Instrument Repairer Instrument Technician (Utilities) Instrumentation Technician Instrument Mechanic (Any Industry) Instrument Repairer (Any Industry) Calibration Laboratory Technician Instrument Mechanic, Weapons System	17-3023.02	4
Electrical Engineering Technicians <i>Recognized Apprenticeship Specialties:</i> Electrical Technician	17-3023.03	3
Electro-Mechanical Technicians <i>Recognized Apprenticeship Specialties:</i> Electromechanical Technician Assembler, Electromechanical	17-3024.00	4
Industrial Engineering Technicians <i>Recognized Apprenticeship Specialties:</i> Industrial Engineering Technician Quality Control Technician	17-3026.00	3
Mechanical Engineering Technicians <i>Recognized Apprenticeship Specialties:</i> Heat-Transfer Technician Mechanical-Engineering Technician Optomechanical Technician Tool Design Checker	17-3027.00	4
Engineering Technicians, Except Drafters, All Other	17-3029.99	NA ¹
Chemical Technician <i>Recognized Apprenticeship Specialties:</i> Chemical Laboratory Technician Laboratory Technician Laboratory Tester Chemical-Engineering Technician	19-4031.00	3
Commercial and Industrial Designers <i>Recognized Apprenticeship Specialties:</i> Commercial Designer Industrial Designer	27-1021.00	4
Occupational Health and Safety Specialists <i>Recognized Apprenticeship Specialties:</i> Safety Inspector/Technician	29-9011.00	5

Electrical and Electronics Repairers, Commercial and Industrial Equipment	49.2094.00	3
<i>Recognized Apprenticeship Specialties:</i>		
<i>Meteorological-Equipment Repairer</i>		
<i>Avionics Technician</i>		
<i>Control Equipment Electrician-Technician</i>		
<i>Electronic-Sales-and-Service Technician</i>		
<i>Field Service Engineer</i>		
Industrial Machinery Mechanics	49-9041.00	3
<i>Recognized Apprenticeship Specialties:</i>		
<i>Maintenance Mechanic, Compressed-Gas Plant</i>		
<i>Automotive-Maintenance-Equipment Servicer</i>		
<i>Bakery-Machine Mechanic</i>		
<i>Conveyor-Maintenance Mechanic</i>		
<i>Composing-Room Machinist</i>		
<i>Electronic-Production-Line-Maintenance Mechanic</i>		
<i>Forge-Shop-Machine Repairer</i>		
<i>Hydroelectric-Machinery Mechanic</i>		
<i>Machine Repairer, Maintenance</i>		
<i>Machinist, Linotype</i>		
<i>Machine Fixer (Carpet and Rug)</i>		
<i>Maintenance Mechanic</i>		
<i>Overhauler (Textile)</i>		
<i>Pinsetter Adjuster, Automatic</i>		
<i>Pump Erector (Construction)</i>		
<i>Repairer, Welding Equipment</i>		
<i>Pneumatic-Tool Repairer</i>		
<i>Pneumatic-Tube Repairer</i>		
<i>Powerhouse Mechanic</i>		
<i>Stoker Erector-and-Servicer</i>		
<i>Rubberizing Mechanic</i>		
<i>Scale Mechanic</i>		
<i>Aviation Support Equipment Repairer</i>		
<i>Fuel-System-Maintenance Worker</i>		
<i>Cooling Tower Technician</i>		
<i>Hydraulic Repairer</i>		
<i>Repairer I</i>		
<i>Hydraulic-Press Servicer</i>		
<i>Canal-Equipment Mechanic</i>		
<i>Treatment-Plant Mechanic</i>		
<i>Pump Servicer</i>		
<i>Repairer, Welding Systems and Equipment</i>		
<i>Industrial Machine System Technician</i>		
Maintenance and Repair Workers, General	49-9042.00	3
<i>Recognized Apprenticeship Specialties:</i>		
<i>Maintenance Repairer, Industrial</i>		

Maintenance Workers, Machinery <i>Recognized Apprenticeship Specialties:</i> <i>Pinsetter Mechanic, Automatic</i>	49-9043.00	1
Medical Equipment Repairers <i>Recognized Apprenticeship Specialties:</i> <i>Electromedical-Equipment Repairer</i> <i>Dental-Equipment Installer and Servicer</i> <i>Biomedical Equipment Technician</i>	49-9062.00	3
Helpers—Installation, Maintenance, and Repair Workers <i>Recognized Apprenticeship Specialties:</i> <i>Service Planner (Light; Heat)</i> <i>Facilities Locator</i>	49-9098.00	2
Coil Winders, Tapers and Finishers	51-2021.00	2
Electrical and Electronic Equipment Assemblers <i>Recognized Apprenticeship Specialties:</i> <i>Wirer</i> <i>Electric-Sign Assembler</i>	51-2022.00	3
Electromechanical Equipment Assemblers <i>Recognized Apprenticeship Specialties:</i> <i>Precision assembler, Bench</i>	51-2023.00	3
Forging Machine Setters, Operators, and Tenders, Metal and Plastic <i>Recognized Apprenticeship Specialties:</i> <i>Die Setter</i> <i>Forging-Press Operator I</i> <i>Multi-Operation-Machine Operator</i> <i>Fastener Technologist</i> <i>Heavy Forger</i>	51-4022.00	2
Engine and Other Machine Assemblers <i>Recognized Apprenticeship Specialties:</i> <i>Machine Builder</i> <i>Machine Assembler</i> <i>Assembler, Aircraft Power Plant</i> <i>Electric-Motor-and-Generator Assembler</i>	51-2031.00	3
Numerical Control Machine Tool Operators and Tenders, Metal and Plastic <i>Recognized Apprenticeship Specialties:</i> <i>Numerical Control Machine Operator</i>	51-4011.01	2
Extruding and Drawing Machine Setters, Operators, and Tenders, Metal and Plastic	51-4021.00	2

Recognized Apprenticeship Specialties:

Extruder Operator

Punching Machine Setters and Set-Up Operators, Metal and Plastic	51-4031.02	2
Press and Press Brake Machine Setters and Set-Up Operators, Metal and Plastic	51-4031.03	2
<i>Recognized Apprenticeship Specialties:</i>		
<i>Spring Coiling Machine Setter</i>		
<i>Press Operator, Heavy Duty</i>		
Shear and Slitter Machine Setters and Set-Up Operators, Metal and Plastic	51-4031.04	2
Drilling and Boring Machine Tool Setters, Operators, and Tenders, Metal and Plastic	51-4032.00	2
Grinding, Honing, Lapping, and Deburring Machine Set-Up Operators	51-4033.01	3
<i>Recognized Apprenticeship Specialties:</i>		
<i>Grinder Set-Up Operator, Jig</i>		
<i>Injection-Molding-Machine Operator</i>		
<i>Mold Setter</i>		
<i>Plastic Process Technician</i>		
Plastic Molding and Casting Machine Operators and Tenders	51-4072.02	1
Metal Molding, Coremaking, and Casting Machine Setters and Set-Up Operators	51-4072.03	2
Metal Molding, Coremaking, and Casting Machine Operators and Tenders	51-4072.04	1
<i>Recognized Apprenticeship Specialties:</i>		
<i>Caster</i>		
Casting Machine Set-Up Operators	51-4072.05	3
Combination Machine Tool Operators and Tenders, Metal and Plastic	51-4081.02	2

Tool and Die Makers	51-4111.00	4
<i>Recognized Apprenticeship Specialties:</i>		
<i>Die Finisher</i>		
<i>Die Maker</i>		
<i>Mold Maker, Die-Casting and Plastic Molding</i>		
<i>Die Maker, Stamping</i>		
<i>Die Maker, Trim</i>		
<i>Die Sinker</i>		
<i>Plastic Tool Maker</i>		
<i>Saw Maker</i>		
<i>Tap-and-Die-Maker Technician</i>		
<i>Tool Maker</i>		
<i>Tool Maker, Bench</i>		
<i>Tool-and-Die Maker</i>		
<i>Die Maker</i>		
<i>Die Maker, Bench, Stamping</i>		
<i>Plastic-Fixture Builder</i>		
<i>Die Maker, Wire Drawing</i>		
Solderers	51-4121.04	1
Soldering and Brazing Machine Operators and Tenders	51-4122.04	1
Heat Treating, Annealing, and Tempering Machine Operators and Tenders, Metal and Plastic	51-4191.02	2
<i>Recognized Apprenticeship Specialties:</i>		
<i>Heat Treater I</i>		
Lay-Out Workers, Metal and Plastic	51-4192.00	3
<i>Recognized Apprenticeship Specialties:</i>		
<i>Lay-Out Worker</i>		
<i>Shipfitter</i>		
Electrolytic Plating and Coating Machine Setters and Set-Up Operators, Metal and Plastic	51-4193.01	3
Nonelectrolytic Plating and Coating Machine Operators and Tenders, Metal and Plastic	51-4193.04	1
<i>Recognized Apprenticeship Specialties:</i>		
<i>Plater</i>		
Platemakers	51-5022.07	3
<i>Recognized Apprenticeship Specialties:</i>		
<i>Lithographic Platemaker</i>		
<i>Photographic-Plate Maker</i>		
Electronic Masking System Operators	51-5022.09	4
Plate Finishers	51-5022.11	5
<i>Recognized Apprenticeship Specialties:</i>		
<i>Plate Finisher</i>		

Design Printing Machine Setters and Set-Up Operators <i>Recognized Apprenticeship Specialties:</i> Printer, Plastic Wallpaper Printer I Lithograph-Press Operator, Tinware	51-5023.04	3
Embossing Machine Set-Up Operators <i>Recognized Apprenticeship Specialties:</i> Embossing-Press Operator Embosser Steel-Die Printer	51-5023.07	3
Engraver Set-Up Operators <i>Recognized Apprenticeship Specialties:</i> Engraving-Press Operator Engraver, Machine	51-5023.08	4
Extruding and Forming Machine Operators and Tenders, Synthetic or Glass Fibers	51-6091.01	1
Auxiliary Equipment Operators, Power	51-8013.02	2
Chemical Equipment Controllers and Operators <i>Recognized Apprenticeship Specialties:</i> Chemical Operator III	51-9011.01	2
Chemical Equipment Tenders	51-9011.02	2
Separating, Filtering, Clarifying, Precipitating, and Still Machine Setters, Operators, and Tenders <i>Recognized Apprenticeship Specialties:</i> Fourdrinier-Machine Operator Recovery Operator (Paper and Pulp) Purification Operator II	51-9012.00	1
Extruding, Forming, Pressing, and Compacting Machine Setters and Set-Up Operators <i>Recognized Apprenticeship Specialties:</i> Forming-Machine Operator	51-9041.01	2
Extruding, Forming, Pressing, and Compacting Machine Operators and Tenders <i>Recognized Apprenticeship Specialties:</i> Auger Press Operator, Manual Control	51-9041.02	1
Semiconductor Processors	51-9141.00	1

Materials Inspectors	51-9061.01	4
<i>Recognized Apprenticeship Specialties:</i>		
Experimental Assembler		
Inspector, Outside Production		
Rubber Tester		
Radiographer; Inspector		
Set-Up and Lay-Out		
Inspector, Metal Fabrication		
Quality-Control Inspector		
Operational Test Mechanic		
Precision Devices Inspectors and Testers	51-9061.03	3
<i>Recognized Apprenticeship Specialties:</i>		
Hydrometer Calibrator		
Inspector, Precision		
Electric-Meter Tester		
X-Ray-Equipment Tester		
Inspector, Electromechanical		
Calibrator, Military (Instruments and Apparatus)		
Coating, Painting, and Spraying Machine Operators and Tenders	51-9121.02	1
<i>Recognized Apprenticeship Specialties:</i>		
Coating-Machine Operator I		
Cleaning, Washing, and Metal Pickling Equipment	51-9192.00	1
Operators and Tenders		
Precision Etchers and Engravers, Hand or Machine	51-9194.01	3
<i>Recognized Apprenticeship Specialties:</i>		
Engraver, Block		
Engraver, Hand, Soft Metals		
Engraver, Picture		
Siderographer		
Sketch Maker II		
Engraver I		
Engraver, Hand, Hard Metals		
Etchers	51-9194.03	3
Pantograph Engravers	51-9194.04	1
<i>Recognized Apprenticeship Specialties:</i>		
Engraver, Pantograph I		
Precision Mold and Pattern Casters, except Nonferrous Metals	51-9195.01	3
<i>Recognized Apprenticeship Specialties:</i>		
Plaster Pattern Caster		
Mold Maker, Hand	51-9195.06	2
<i>Recognized Apprenticeship Specialties:</i>		
Mold Maker (Pottery and Porcelain)		
Molding and Casting Workers	51-9195.07	2

Recognized Apprenticeship Specialties:

Cell Maker

Production Workers, All Other	51-9199.99	NA ²
First-Line Supervisors/Managers of Production and Operating Workers	53-1011.00	3
First-Line Supervisors/Managers of Helpers, Laborers, and Material Movers, Hand	53-1021.00	3
Conveyor Operators and Tenders <i>Recognized Apprenticeship Specialties:</i> <i>Conveyor-System Operator</i>	53-7011.00	1
Machine Feeders and Offbearers	53-7063.00	1
Packers and Packagers, Hand	53-7064.00	1
Gas Compressor Operators	53-7071.02	4

(Footnotes)

¹ Data are not collected for this “residual” (also called “all other”) occupational title.

² Data are not collected for this “residual” (also called “all other”) occupational title.

Job Zone Definitions

The “Five Zone” rating system does not represent occupations in a developmental sequence. However, due to the limited amount of jobs available in zones 1 (little or no preparation needed) and 2 (some preparation needed); it is evident that industry is requiring additional training and education of the workforce. Students will need to explore the “assistant” or “entry-level” positions that may be available (but not identified in O*NET) within the occupation areas. By utilizing this tool, students should begin to see a significant number of skills as “transferable” to many related job opportunities within the program area.

Job Zone One

Little or No Preparation Needed. No previous work-related skill, knowledge, or experience is needed for these occupations. For example, a person can become a general office clerk even if s/he has never worked in an office before. These occupations may require a high school diploma or GED certificate. Some may require a formal training course to obtain a license. Employees in these occupations need anywhere from a few days to a few months of training. Usually, an experienced worker could show you how to do the job. These occupations involve following instructions and helping others. Examples include: bus drivers, forest and conservation workers, general office clerks, home health aides, and waiters/waitresses. (Below 4.0)

Job Zone Two

Some Preparation Needed. Some previous work-related skill, knowledge, or experience may be helpful in these occupations, but usually is not needed. For example, a drywall installer might benefit from experience installing drywall, but an inexperienced person could still learn to be an installer with little difficulty. These occupations usually require a high school diploma and may require some vocational training or job-related course work. In some cases, an associate’s or bachelor’s degree could be needed. Employees in these occupations need anywhere from a few months to one year of working with experienced employees. These occupations often involve using your knowledge and skills to help others. Examples include drywall installers, fire inspectors, flight attendants, pharmacy technicians, salespersons (retail), and tellers. (4.0 to < 6.0)

Job Zone Three

Medium Preparation Needed. Previous work-related skill, knowledge, or experience is required for these occupations. For example, an electrician must have completed three or four years of apprenticeship or several years of vocational training, and often must have passed a licensing exam, in order to perform the job. Most occupations in this zone require training in vocational schools, related on-the-job experience, or an associate’s degree. Some may require a bachelor’s degree. Employees in these occupations usually need one or two years of training involving both on-the-job experience and informal training with experienced workers. These occupations usually involve using communication and organizational skills to coordinate, supervise, manage, or train others to accomplish goals. Examples include dental assistants, electricians, fish and game wardens, legal secretaries, personnel recruiters, and recreation workers. (6.0 to <7.0)

Job Zone Four

Considerable Preparation Needed. A minimum of two to four years of work-related skill, knowledge, or experience is needed for these occupations. For example, an accountant must complete four years of college and work for several years in accounting to be considered qualified. Most of these occupations require a four-year bachelor's degree, but some do not. Employees in these occupations usually need several years of work-related experience, on-the-job training, and/or vocational training. Many of these occupations involve coordinating, supervising, managing, or training others. Examples include accountants, chefs and head cooks, computer programmers, historians, pharmacists, and police detectives. (7.0 to < 8.0)

Job Zone Five

Extensive Preparation Needed. Extensive skill, knowledge, and experience are needed for these occupations. Many require more than five years of experience. For example, surgeons must complete four years of college and an additional five to seven years of specialized medical training to be able to do their jobs. A bachelor's degree is the minimum formal education required for these occupations. However, many also require graduate school. For example, they may require a master's degree, and some require a Ph.D., M.D., or J.D. (law degree). Employees may need some on-the-job training, but most of these occupations assume that the person will already have the required skills, knowledge, work-related experience, and/or training. These occupations often involve coordinating, training, supervising, or managing the activities of others to accomplish goals. Very advanced communication and organizational skills are required. Examples include athletic trainers, lawyers, managing editors, physicists, social psychologists, and surgeons. (8.0 and above)

<http://online.onetcenter.org>

For information regarding requirements for employment:

Click on **“Find Occupation”**.

Type in (**selected occupation**) or use code if you know it. (click on **Go**)

Select one of the more specific related occupations on the list.

On the **“Summary Report for:”** page, you may choose **Summary, Details,** and/or **Custom**

For information regarding wages and employment:

Go the bottom of any of the pages under **“Summary Report for:”** and select the Link: **“Wages and Employment”**.

Under **“Select a State”**, choose **“Arizona”**. (click on **Go**)

This gives wages (hourly and annual) for Arizona compared with USA from Bureau of Labor Statistics, Office of Employment Projections and Arizona Department of Security. You will also see national trends in USA over a ten year period.

Note: To print any of these, scroll to top of page, right corner, where it says **“Printer-Friendly Version”**.

Design Team Members

Industrial Manufacturing

CIP No. 15.0600

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Design Team Members

Industrial Manufacturing

CIP No. 15.0600

External Review

Participants will be listed and viewed on the Tech Prep web site by September, 2005

Project Director

Virtual Habitats

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