

AE-PLC-A.  
Feeding Workstation for  
Pieces.

AE-PLC-M.  
Mounting Workstation

AE-BR.  
Robotic Arm  
Workstation

AE-PLC-T.  
Linear Transport  
Workstation

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↳ PRODUCTS  
↳ 6.- MECHATRONICS,  
AUTOMATION &  
COMPU MECHATRONICS

### INTRODUCTION

Since the 1950s, the computer integration in the manufacturing systems it has been a complete revolution, increasing productivity and quality of all type of products. These computer integration systems included a lot of component from very different technologies as hydraulic, pneumatic, electrical, robotics, chemical, etc. For this reason these types of systems requires workers with specific skills to ensure that they are working properly.

The Flexible Manufacturing System 15, "AE-PLC-FMS15", has been designed by EDIBON to study how work a complete manufacturing system.

The "AE-PLC-FMS15" system includes a set of practical exercises through which the student will understand how work an automatic pieces feeding system, a sorting system, a robotic arm system and an automatic milling process.



ISO 9001: Quality Management (for  
Design, Manufacturing, Commercialization  
and After-sales service)



European Union Certificate  
(total safety)



Certificates ISO 14001 and ECO-  
Management and Audit Scheme  
(environmental management)



"Worlddidac Quality Charter"  
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## GENERAL DESCRIPTION

The Flexible Manufacturing System 15, "AE-PLC-FMS15" is a modular system composed of four workstations: the "AE-PLC-A" Feeding Workstation for Pieces, the "AE-PLC-M" Mounting Workstation, the "AE-PLC-T" Linear Transport Workstation and the "AE-BR" Robotic Arm Workstation.

The objective of the "AE-PLC-FMS15" system is to provide a base piece and mount three different pieces and screws inside it, once the piece is complete, the system stores it in a specific position.

The process of the "AE-PLC-FMS15" is explained in the following lines:

- First, the feeding system provides the base pieces with the correct dimensions and place them on the linear transport system.
- Then, the mounting workstation provide another piece, and after verify that is correct, mount them inside the base piece placed on the linear transport system.
- Finally, the Robotic Arm Workstation pick the sorted pieces and store them.

The "AE-PLC-FMS15" system design by EDIBON allows the users to learn the basic concepts of automation as the operation of an Ethernet network or how to program a PLC and about other areas as pneumatic, electro-pneumatic, vacuum technology, etc.

## SPECIFICATIONS

### AE-PLC-A. Feeding Workstation for Pieces.

Its function is to supply the base piece to the system. The "AE-PLC-A" includes a place where the pieces are stored before being supplied one by one by a pneumatic cylinder. Then, the position of the piece will be verified in order to activate the mechanism that checks whether the shape of the piece is correct. Afterwards, the piece is displaced from the station to the Linear Transport Workstation "AE-PLC-T" by a vacuum system consisting of suction pads mounted on a manipulator arm to continue with the manufacturing process.

Included elements:

Specifications:

Mounted with aluminum profiles.

10 pieces made of aluminum.

Vertical storage for pieces.

Table with four wheels with brake.

Control panel:

Emergency pushbutton.

Start/Stop pushbuttons.

Manual/automatic switch.

Light indicators for signaling.

Pneumatic circuit:

Air treatment unit:

Filter-regulator with water trap.

Manometer with double scale indicator.

Shut-off valve.

Cylindrical simple effect pneumatic actuator:

Material: stainless steel.

Normally retracted rod.

Diameter: 20 mm.

Stroke of 100 mm.

Cylindrical pneumatic simple effect actuator:

Material: stainless steel.

Normally retracted rod.

Diameter: 10 mm.

Stroke of 50 mm.

2 profile pneumatic double effect actuators:

Material: stainless steel and aluminum.

Normally retracted rod.

Stroke of 200 mm.

## Specifications

Profile pneumatic double effect actuator:

Material: stainless steel and aluminum.

Stroke of 100 mm.

2 pneumatic monostable 3/2 solenoid valves.

3 pneumatic bistable 5/2 solenoid valves.

Individually identified tubes and push in fittings.

Vacuum circuit:

Venturi effect vacuum ejectors.

4 telescopic flat suction pads made of NBR rubber mounted on an aluminum plate.

Vacuum switch.

Pneumatic monostable 3/2 solenoid valve.

Sensors:

2 inductive effect sensors to check the position of the piece.

8 reed effect limit switches to check the position of the pneumatic actuators.

Required elements:

**PLC: Available PLC models of different manufacturers: PANASONIC, SIEMENS, OMRON, MITSUBISHI, ALLEN BRADLEY, etc. (AE-PLC-PAN, AE-PLC-SIE, AE-PLC-OMR, AE-PLC-MIT, AE-PLC-AB).**

Recommended elements:

### SAC. Silent Air Compressor Unit.

Designed to work with the EDIBON units.

Single-phase motor with 340 W.

Low noise level with 40 dB of maximum.

Boiler capacity: 9 l.

Maximum pressure: 8 bar or 0.8 MPa.

Maximum air flow: 50 l/min.

Safety relief valve.

Start/stop switch.

Double scale manometer psi and bar with a range from 0 to 12 bar to measure the air pressure before the air filter regulator.

Air Filter Regulator (FR):

Double scale manometer psi and bar with a range from 0 to 12 bar to measure the air pressure after the air filter regulator.

Air filter with drain.

Air pressure regulator from 0 to 8 bar.

6 mm quick release connector of 6mm for pneumatic flexible tubes.

Oil level indicator.

The oil necessary to work is included with the unit.

Include the connector types to work with pneumatic trainers of EDIBON.



SAC

**AE-PLC-M. Mounting Workstation.**

Its function is to supply a second piece and to assemble it to the base piece already supplied by the previous module "AE-PLC-A".

The "AE-PLC-M" includes a vertical storage for the pieces that will be supplied one by one to the system by a pneumatic cylinder. Once the position of the piece is detected, the mechanism that measures whether the piece is correct with a linear potentiometer is activated. After checking the height, the faulty pieces will be discarded and stored in a rejection store. If the height of the piece is acceptable, an inside grip clamp pneumatic actuator coupled to a rotating pneumatic actuator, that works as rotating arm, will assemble the new piece to the base piece already supplied by the "AE-PLC-A" that reaches to the "AE-PLC-M" station through the Linear Transport Workstation "AE-PLC-T". The piece is assembled to the "AE-PLC-T" to continue with the manufacturing process.

Included elements:

Specifications:

Mounted with aluminum profiles.

15 pieces.

Vertical storage for base pieces.

Table with four wheels with brake.

Vertical storage for pieces.

Control panel:

Emergency pushbutton.

Start/Stop pushbuttons.

Manual/automatic switch.

Light indicators for signaling.

Pneumatic circuit:

Air treatment unit:

Filter-regulator with water trap.

Manometer with double scale indicator.

Shut-off valve.

2 cylindrical simple effect pneumatic actuators:

Material: stainless steel.

Normally retracted rod.

Diameter: 20 mm.

Stroke of 100 mm.

Rodless pneumatic actuator with bands:

Material: stainless steel and aluminum.

Stroke of 300 mm.

Limit switch sensors at the desired start and end positions.

## Specifications

2 pneumatic double effect inside grip clamps.

Rotary pneumatic actuator.

Rotary pneumatic actuator with 50 mm stroke rod.

2 pneumatic monoestable 3/2 solenoid valves.

4 pneumatic bistable 5/2 solenoid valves.

Spring centered 5/3 pneumatic solenoid valve.

Individually identified tubes and push in fittings.

### Sensors:

Linear potentiometer of 20 mm stroke to check the height of the piece.

Inductive effect sensor to check the position of the piece.

Two limit switches to check the position of the measuring mechanism.

Ten reed effect limit switches to check the position of the pneumatic actuators.

### Required elements:

**PLC: Available PLC models of different manufacturers: PANASONIC, SIEMENS, OMRON, MITSUBISHI, ALLEN BRADLEY, etc. (AE-PLC-PAN, AE-PLC-SIE, AE-PLC-OMR, AE-PLC-MIT, AE-PLC-AB).**

### Recommended elements:

#### SAC. Silent Air Compressor Unit.

Designed to work with the EDIBON units.

Single-phase motor with 340 W.

Low noise level with 40 dB of maximum.

Boiler capacity: 9 l.

Maximum pressure: 8 bar or 0.8 MPa.

Maximum air flow: 50 l/min.

Safety relief valve.

Start/stop switch.

Double scale manometer psi and bar with a range from 0 to 12 bar to measure the air pressure before the air filter regulator.

Air Filter Regulator (FR):

Double scale manometer psi and bar with a range from 0 to 12 bar to measure the air pressure after the air filter regulator.

Air filter with drain.

Air pressure regulator from 0 to 8 bar.

6 mm quick release connector of 6mm for pneumatic flexible tubes.

Oil level indicator.

The oil necessary to work is included with the unit.

Include the connector types to work with pneumatic trainers of EDIBON.



SAC

**AE-PLC-T. Linear Transport Workstation.**

Its function is to transport pieces between the different working stations that will perform the different assembly operations. The "AE-PLC-T" has eight stops where the working stations will be installed.

Included elements:

Specifications:

Mounted with aluminum profiles.

Four pallets to transport the pieces.

Eight stops for the pallets:

One stop per working station.

Eight retaining devices.

There is a rotating actuator with a 50 mm rod in the stop where the "AE-PLC-AT" system will be installed to make the piece rotate.

Electrical panel:

Differential magneto-thermal switch.

Power supply of 24 VDC.

Terminal block to connect the individually identified inputs and outputs of the unit.

Control panel:

Emergency pushbutton.

Start/Stop pushbuttons.

Manual/automatic switch.

Light indicators for signaling.

Pneumatic circuit:

Air treatment unit:

Filter-regulator with water trap.

Manometer with double scale indicator.

Shut-off valve.

Air intake in every working station to supply pressurized air to each unit.

13 cylindrical simple effect pneumatic actuators:

Material: stainless steel.

Normally retracted rod.

Diameter: 20 mm.

Stroke of 50 mm.

Rotating pneumatic actuator with a 50 mm rod.

## Specifications

14 NC pneumatic monostable 3/2 solenoid valves.

Spring centered 5/3 pneumatic solenoid valve.

Individually identified tubes and push in fittings.

### Sensors:

24 inductive effect sensors to detect the presence of the pallet.

Four reed effect limit switches to check the position of the pneumatic actuators.

Single-phase motor to move the conveyor belt.

### Required elements:

**PLC: Available PLC models of different manufacturers: PANASONIC, SIEMENS, OMRON, MITSUBISHI, ALLEN BRADLEY, etc. (AE-PLC-PAN, AE-PLC-SIE, AE-PLC-OMR, AE-PLC-MIT, AE-PLC-AB).**

### Recommended elements:

#### SAC. Silent Air Compressor Unit

Designed to work with the EDIBON units.

Single-phase motor with 340 W.

Low noise level with 40 dB of maximum.

Boiler capacity: 9 l.

Maximum pressure: 8 bar or 0.8 MPa.

Maximum air flow: 50 l/min.

Safety relief valve.

Start/stop switch.

Double scale manometer psi and bar with a range from 0 to 12 bar to measure the air pressure before the air filter regulator.

#### Air Filter Regulator (FR):

Double scale manometer psi and bar with a range from 0 to 12 bar to measure the air pressure after the air filter regulator.

Air filter with drain.

Air pressure regulator from 0 to 8 bar.

6 mm quick release connector of 6mm for pneumatic flexible tubes.

Oil level indicator.

The oil necessary to work is included with the unit.

Include the connector types to work with pneumatic trainers of EDIBON.



SAC



**AE-BR. Robotic Arm Station.**

The Robotic Arm Station moves the pieces to another place of the production system. In this case, the robot stores the pieces in an exit box.

Included elements:

Specifications:

Mounted with aluminum profiles.

Table with four wheels with brake.

Control panel:

Emergency pushbutton.

Start/Stop pushbuttons.

Manual/automatic switch.

Light indicators for signaling.

Pneumatic circuit:

Air treatment unit:

Filter-regulator with water trap.

Manometer with double scale indicator.

Shut-off valve.

Pneumatic bistable 5/2 solenoid valve.

Robotic arm:

6 degrees of freedom.

Maximum load capacity: 2 Kg.

Weight: 19 Kg.

Position repeatability:  $\pm 0.02$  mm.

Detection method: absolute encoder.

Arm length: 500 mm max.

Console to program the robotic arm.

Electric drill to install in the robotic arm.

Pneumatic double effect external grip clamp to install in the robotic arm.

Protection screen made of polycarbonate.

Required elements:

**PLC: Available PLC models of different manufacturers: PANASONIC, SIEMENS, OMRON, MITSUBISHI, ALLEN BRADLEY, etc. (AE-PLC-PAN, AE-PLC-SIE, AE-PLC-OMR, AE-PLC-MIT, AE-PLC-AB).**

Recommended elements:

**SAC. Silent Air Compressor Unit.**

Designed to work with the EDIBON units.

Single-phase motor with 340 W.

Low noise level with 40 dB of maximum.

Boiler capacity: 9 l.

Maximum pressure: 8 bar or 0.8 MPa.

Maximum air flow: 50 l/min.

Safety relief valve.

Start/stop switch.

Double scale manometer psi and bar with a range from 0 to 12 bar to measure the air pressure before the air filter regulator.

Air Filter Regulator (FR):

Double scale manometer psi and bar with a range from 0 to 12 bar to measure the air pressure after the air filter regulator.

Air filter with drain.

Air pressure regulator from 0 to 8 bar.

6 mm quick release connector of 6mm for pneumatic flexible tubes.

Oil level indicator.

The oil necessary to work is included with the unit.

Include the connector types to work with pneumatic trainers of EDIBON.

**Cables and Accessories**, for normal operation.

**Manuals:**

This unit **is supplied with the following manuals:** Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.



## EXERCISES AND PRACTICAL POSSIBILITIES

Practical possibilities to be done with the Flexible Manufacturing System 15 (AE-PLC-FMS15):	15.- Optimize the process time.
1.- Introduction to flexible manufacturing system (FMS).	- Mounting Workstation (AE-PLC-M).
2.- Introduction to pneumatics and electro-pneumatics.	16.- Manual control of a mounting system.
3.- Introduction to vacuum technology.	17.- Automatic control of a mounting system.
4.- Study of the sensor detection.	18.- Change the parameters of the mounting process.
5.- Testing the digital inputs and outputs of the automatic system through a PLC.	19.- Optimization of the process time.
6.- Modify manufacturing parameters through the PLC.	20.- Study and analysis of the faults inserted in the process with the fault generation module.
7.- Configuration of a pneumatic application.	- Robotic Arm Workstation (AE-BR).
8.- Introduction to the Human-machine interface systems (HMI).	21.- Introduction to robotic systems.
9.- Study of an automatic control of an industrial system.	22.- Robotic arm configuration.
10.- Control of the flexible manufacturing system through a central PLC in an Ethernet network with local PLC in each workstation.	23.- Set a simple movement of the robotic arm.
11.- Manage the flexible manufacturing system through the HMI device.	24.- Configuration of a pneumatic application.
Practical possibilities to be done with the Workstation alone:	25.- Set a simple pick and place function with the robotic arm.
- Feeding Workstation for Pieces (AE-PLC-A).	- Linear Transport Workstation (AE-PLC-T).
12.- Manual control of a Feeding system.	26.- Manual control of a transporting system.
13.- Automatic control of a Feeding system.	27.- Automatic control of a transporting system.
14.- Change the parameters of the Feeding process.	28.- Change the parameters of a transporting process.
	29.- Optimize the process time.
	- Several other exercises can be done and designed by the user.

## REQUIRED SERVICES

- Electrical supply: single phase, 220V/50 Hz or 110V/60 Hz.
- Compressed air with a 50 l/min of airflow and 8 bar of pressure.
- Computer.

## DIMENSIONS AND WEIGHTS

### AE-PLC-FMS15:

- Dimensions: 3000 x 1800 x 1700 mm. approx.  
(118.10 x 70.86 x 66.92 inches approx.)
- Weight: 640 Kg. approx.  
(1410 pounds approx.).

## RECOMMENDED ELEMENTS (Not included)

- SAC. Silent Air Compressor Unit.

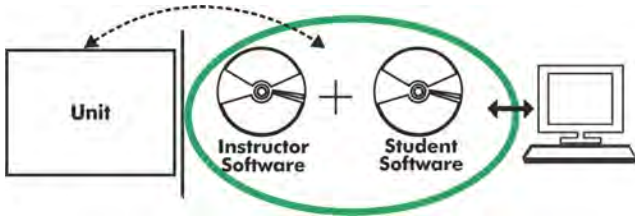
## REQUIRED ELEMENTS (Not included)

- PLC: Available PLC models of different manufacturers: PANASONIC, SIEMENS, OMRON, MITSUBISHI, ALLEN BRADLEY, etc. (AE-PLC-PAN, AE-PLC-SIE, AE-PLC-OMR, AE-PLC-MIT, AE-PLC-AB).

## AVAILABLE VERSIONS

- Offered in this catalogue:
- AE-PLC-FMS15. Flexible Manufacturing System 15.
- Offered in other catalogue:
- AE-PLC-FMS1. Flexible Manufacturing System 1.
  - AE-PLC-FMS2. Flexible Manufacturing System 2.
  - AE-PLC-FMS3. Flexible Manufacturing System 3.
  - AE-PLC-FMS4. Flexible Manufacturing System 4.
  - AE-PLC-FMS5. Flexible Manufacturing System 5.
  - AE-PLC-FMS6. Flexible Manufacturing System 6.
  - AE-PLC-FMS7. Flexible Manufacturing System 7.
  - AE-PLC-FMS8. Flexible Manufacturing System 8.
  - AE-PLC-FMS9. Flexible Manufacturing System 9.
  - AE-PLC-FMS10. Flexible Manufacturing System 10.
  - AE-PLC-FMS11. Flexible Manufacturing System 11.
  - AE-PLC-FMS12. Flexible Manufacturing System 12.
  - AE-PLC-FMS13. Flexible Manufacturing System 13.
  - AE-PLC-FMS14. Flexible Manufacturing System 14.

**AE-PLC-FMS15/ICAI. Interactive Computer Aided Instruction Software System:**



With no physical connection between unit and computer, this complete software package consists of an Instructor Software (EDIBON Classroom Manager -ECM-SOF) totally integrated with the Student Software (EDIBON Student Labsoft -ESL-SOF). Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students.

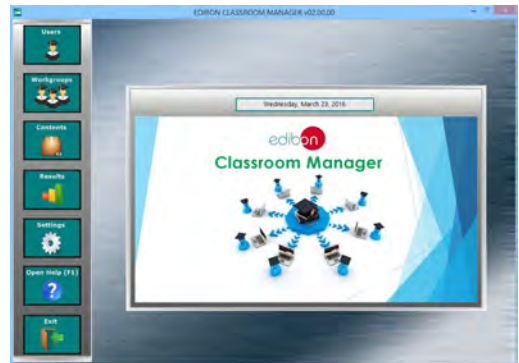
Instructor Software

- ECM-SOF. EDIBON Classroom Manager (Instructor Software).

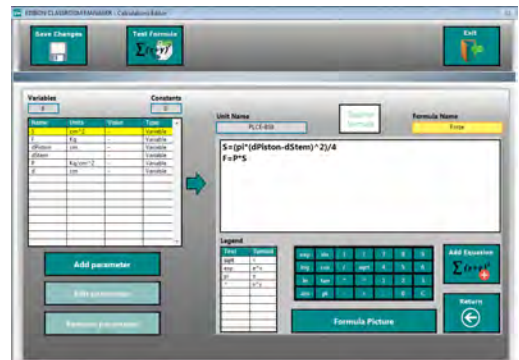
ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual students, workgroups, units, etc... so the teacher can know in real time the level of understanding of any student in the classroom.

Innovative features:

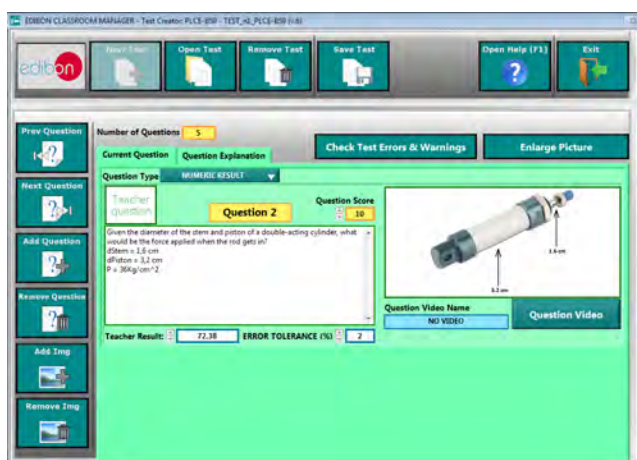
- User Data Base Management.
- Administration and assignment of Workgroup, Task and Training sessions.
- Creation and Integration of Practical Tests and Multimedia Resources.
- Custom Design of Evaluation Methods.
- Creation and assignment of Formulas & Equations.
- Equation System Solver Engine.
- Updatable Contents.
- Report generation, User Progression Monitoring and Statistics.



ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen



ECAL. EDIBON Calculations Program Package - Formula Editor Screen



ETTE. EDIBON Training Test & Exam Program Package - Main Screen with Numeric Result Question



ERS. EDIBON Results & Statistics Program Package - Student Scores Histogram

**Student Software**

- ESL-SOF. **EDIBON Student Labsoft (Student Software)**.

ESL-SOF is the application addressed to the Students that helps them to understand theoretical concepts by means of practical exercises and to prove their knowledge and progression by performing tests and calculations in addition to Multimedia Resources. Default planned tasks and an Open workgroup are provided by EDIBON to allow the students start working from the first session. Reports and statistics are available to know their progression at any time, as well as explanations for every exercise to reinforce the theoretically acquired technical knowledge.

Innovative features:

- Student Log-In & Self-Registration.
- Existing Tasks checking & Monitoring.
- Default contents & scheduled tasks available to be used from the first session.
- Practical Exercises accomplishment by following the Manual provided by EDIBON.
- Evaluation Methods to prove your knowledge and progression.
- Test self-correction.
- Calculations computing and plotting.
- Equation System Solver Engine.
- User Monitoring Learning & Printable Reports.
- Multimedia-Supported auxiliary resources.

For more information see ICAI catalogue. Click on the following link:

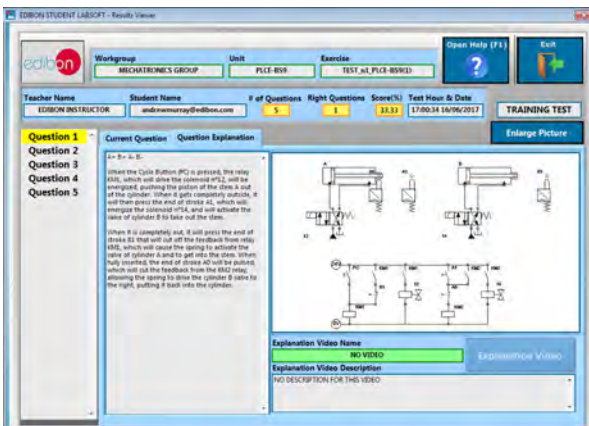
[www.edibon.com/en/files/expansion/ICAI/catalog](http://www.edibon.com/en/files/expansion/ICAI/catalog)



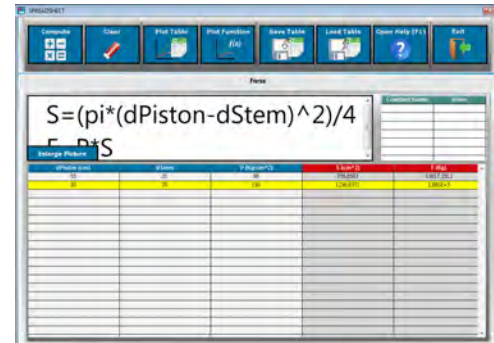
ESL-SOF. EDIBON Student LabSoft (Student Software) Application Main Screen



EPE. EDIBON Practical Exercise Program Package Main Screen



ERS. EDIBON Results & Statistics Program Package - Question Explanation



ECAL. EDIBON Calculations Program Package Main Screen

\* Specifications subject to change without previous notice, due to the convenience of improvement of the product.



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REPRESENTATIVE:

