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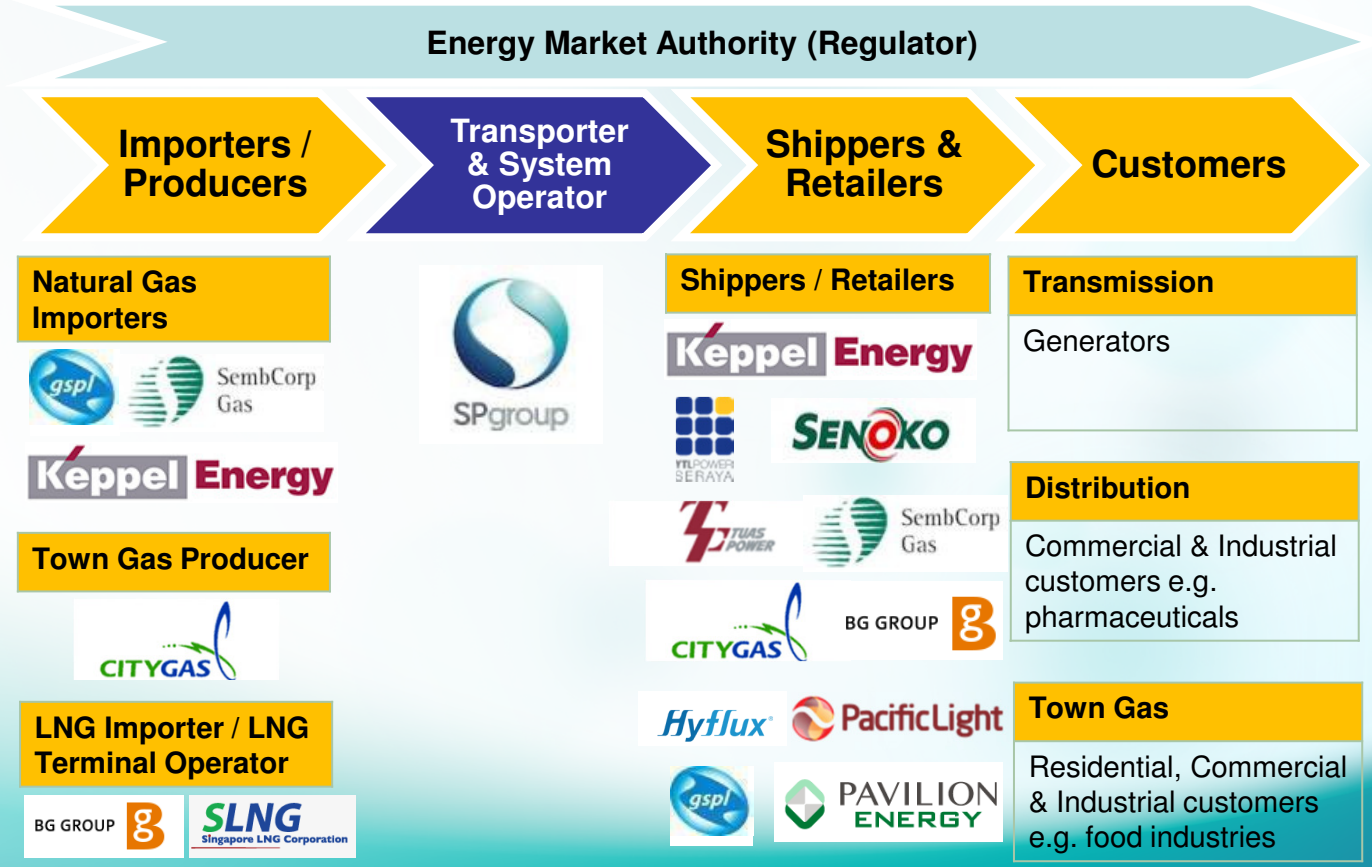
Gas Network Planning

Jeffrey Lim
Head of Section - SPPG Gas Network Planning

Presentation Outline

1. Singapore Gas Industry
2. Overview of Town Gas & Natural Gas Networks
3. Key equipment in TG & NG distribution networks – District regulators and MPRS
4. Pipeline specifications
5. Pipeline routing considerations

Singapore Gas Industry



Overview of Town Gas & Natural Gas Networks

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Town Gas (TG)



- Manufactured at Senoko Gasworks by CityGas Pte Ltd
- Production via steam reformation of Natural Gas or Naptha
- Main constituents are Hydrogen (43%-65%) and Methane (4%-28%)
- Odorised for safety at Senoko Gasworks







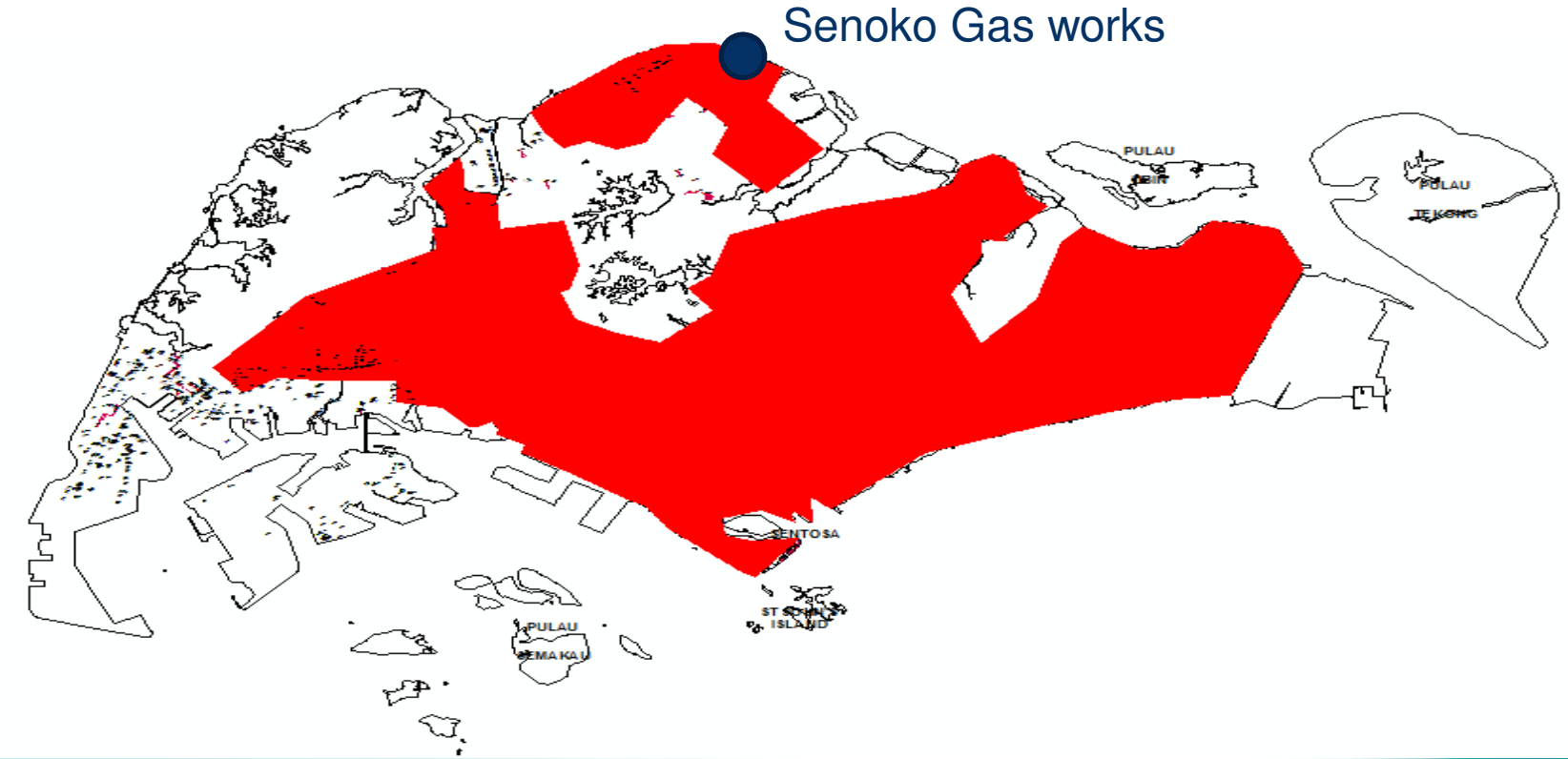
TG is piped to industrial, commercial & residential customers using the TG network

Town Gas Network

- Transmission Network: ~ 80km
  - Steel and PE pipeline
  - Pressure: 3 barg (or 300 kPa)

- Distribution Network: ~ 3,000km
  - Predominantly Ductile Iron and PE Pipeline
  - Pressure: 0.02 to 0.5 barg

Town Gas Supply availability



Natural Gas (NG)

- Supply sources:
  - Piped Natural Gas (PNG) imported via:
    - Sembcorp Gas ORF (from West Natuna, Indonesia)
    - Sakra ORF (from South Sumatra, Indonesia)
    - Attap Valley ORF (from Malaysia)
  - Liquefied Natural Gas (LNG)
    - British Gas (SLNG Terminal in Jurong Island)
- Main constituent is Methane (80%)
- Supplied to commercial and industrial users
- Odorised for safety at ORFs & Terminals

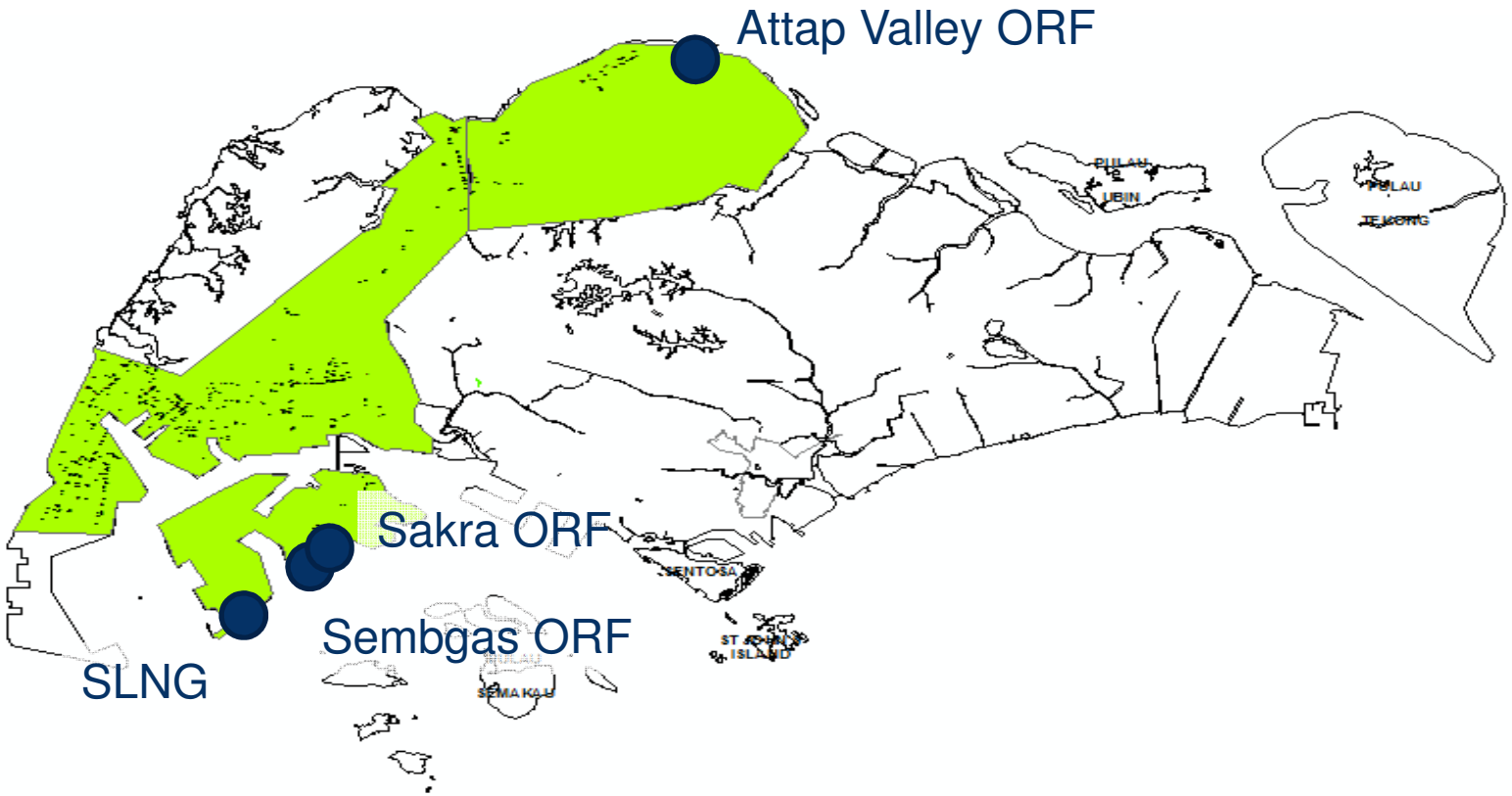
Natural Gas Network

- 2 Networks:
  - Network 1 (supplied by Sembcorp Gas ORF)
  - Network 2 (supplied by AV ORF, Sakra ORF, SLNG Terminal)
- Transmission Network : ~ 200km
  - Steel pipeline
  - Pressure: 28 to 40 barg
- Medium Pressure Distribution Network: ~ 170 km
  - PE Pipeline
  - Pressure: 3 to 6 barg



Sakra NG Station

Natural Gas Supply availability



NG is available predominantly in Western Singapore

Pressure Regime







District Regulator

40 Barg / 28 Barg

3 Barg / 6 Barg

0.5 Barg / 0.2 Barg

0.002 Barg

Low Pressure Customers







Delivering 12,000 m Sm³ / year of NG to ~200 customers

300 m sm³ / year of TG to ~ 800,000 customers

Major Differences between Town Gas and Natural Gas Composition

- NG odorized with Tetrahydrothiophene ("THT") in Sakra ORF, Attap Valley ORF, SLNG and downstream of SembGas ORF

	Town Gas	Natural Gas
Oxygen	0.5% - 1.5%	0.1%
Methane	3% - 20%	80%
Carbon dioxide	11% - 23%	5%

Key Equipment in TG & NG Distribution Networks

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District Regulators

- For the TG network, last leg of pressure reduction is from 0.5 barg to 0.02 – 0.2 barg to convey to customer connections.
- This is accomplished via district regulators.
- District reg are housed in OG boxes
- Typical footprint is 1.5m x 0.5m
- Consist of:
  - Filter
  - Active/slam shut valve
  - One/two regulator streams



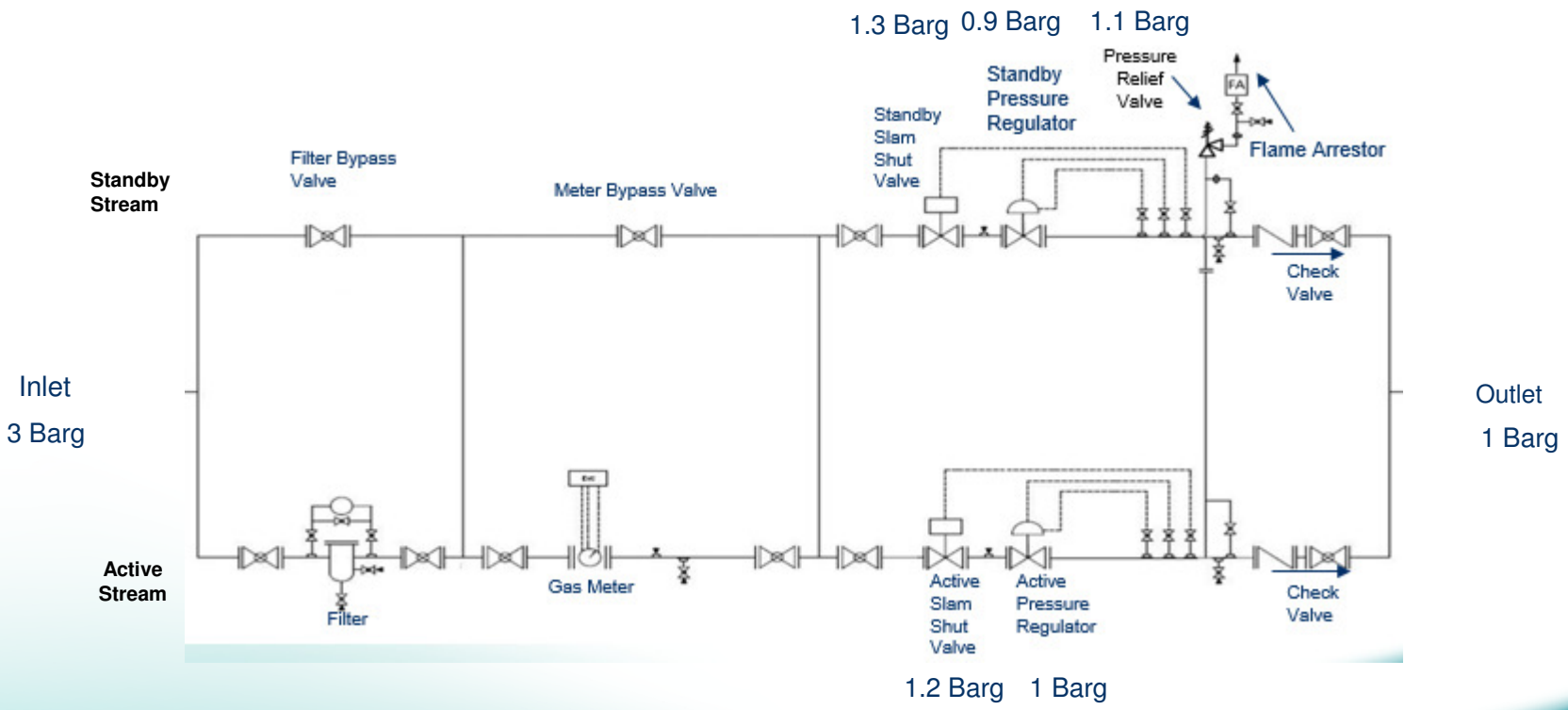
Metering and Pressure Regulating Skid (MPRS)

- For metering and pressure regulation to Natural Gas medium pressure customers
- Installed within customer's premises
- Inlet pressure typically 3-6 barg and outlet 1-2 barg
- Typical footprint is 2.3m by 1.1m
- Coordination between SPPG and customer required during commissioning/shut-downs to avoid SSV activation
- Consists of:
  - Filter
  - Meter
  - Two active/slam regulator streams
  - PRV



Metering & Pressure Regulating Skid (MPRS)
to regulate pressure and measure quantity of gas supply to customer

MPRS Process Flow Diagram



Typical pressure set points

Pipeline Specifications

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Typical steel pipeline specification

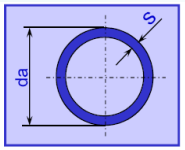
	Item	Description
1.	Reference Standard	AS2885
2.	Pipe Material	API 5L-PSL 2 X52 - X65
3.	Pipeline nominal diameter	300mm - 700mm
4.	Wall Thickness	12.7mm – 14.7mm (straight pipe) 14.3 – 17.6mm (Bends)
5.	Flange specification	Class 300 (28 barg OP) Class 600 (40 barg OP) Class 900 (>40 barg barg OP)
6.	Steel carbon equivalent	Max 0.35%
7.	Design Temperature	0°C – 50°C
8.	Design Pressure	40-50 barg
9.	Max Operating Pressure	3 barg (TG) 40 barg [NG]
10.	Tie-in point	Underground - butt weld Aboveground - Mechanical Flange
11.	Depth of buried pipeline (top of pipe to surface)	Normally about 1.6m subject to site conditions





Typical PE pipeline specification

	Item	Description
1.	Reference Standard	BS EN 1555 SS 608
2.	Pipe Material	Polyethylene Pipe, PE80/100
3.	Pipeline nominal diameter	63mm - 500mm
4.	Standard Dimension Ratio	11, 17.6 & 21
5.	Design Factor	2.9
6.	Design Pressure	3 - 7 Barg
7.	Max Operating Pressure	Network dependent
8.	Jointing	Underground: Butt and electrofusion weld Aboveground - Mechanical Flange
9.	Depth of buried pipeline (top of pipe to surface)	Normally about 1m subject to site conditions



$$SDR = \frac{da}{s}$$

SDR ... standard dimension ratio
da ... outside diameter [mm]
s ... wall thickness [mm]







Pipeline Damage Prevention

1. Pipeline Protective Measures:
    - Concrete Slab
    - Marker tape
    - Warning signage
2. Regular pipeline surveillance
3. Procedures for work near pipelines
4. Proactive third party engagement



Pressure Testing

- All pipelines to be pressure tested after installation.
- TG Dist: 140kPa (2hrs) and 140kPa(22hrs)
- NG Dist: 10.5 barg (2hrs) and 9.1 barg(24 hrs)
- Transmission Pipelines: 1.25x DP (2hrs) and 1.1x DP (24hrs)

Pipeline routing considerations

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Pipeline routing considerations

- Installation methodology
  - Open cut laying
  - Pipe jacking
  - Pipe rack laying
- Typical top of pipe to ground depth is 1 – 1.6m
- Avoid obstacles like utilities eg large sewers and water crossings
- Pipeline routing along road reserve corridors



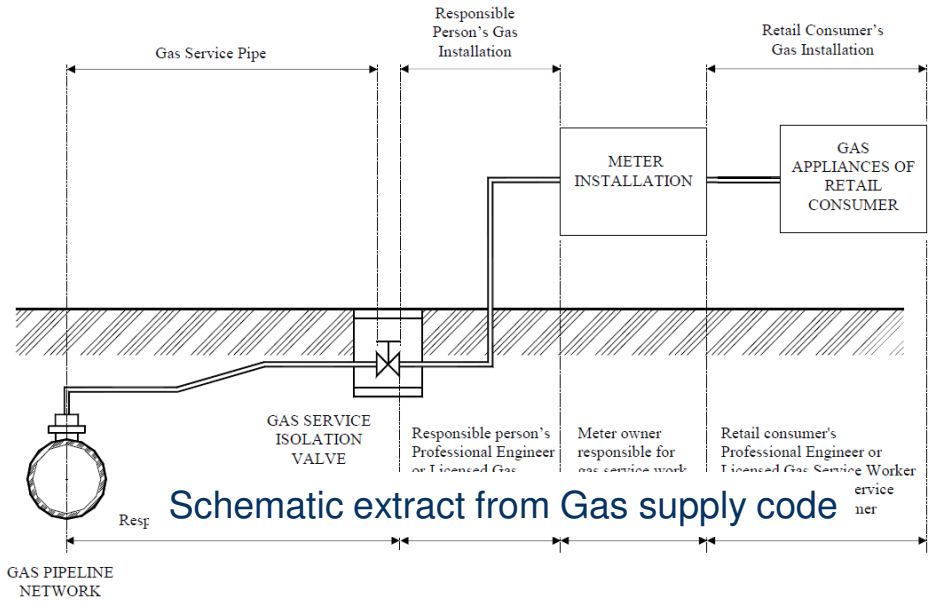
Open Cut laying



Pipe jacking

Customer connection considerations

- GSIV location to be determined by transporter (near boundary line) – in accordance to Gas Supply Regulations
- Tie – in points
- Gas installation downstream of GSIV is properly designed esp for incoming gas pressure
- Typical and peak flow rate
- Metering facility locations where applicable
- Expected commissioning date



Schematic extract from Gas supply code



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