Pumping Solutions for Steam Assisted Gravity Drainage (SAGD)
SPX - An Introduction

SPX is a Fortune 500 multi-industry manufacturing leader, headquartered in Charlotte, North Carolina. SPX manufactures and markets products, components, services and technologies that are integral to meeting today's challenges and tomorrow's needs. We are a place where innovation is fostered, and the real needs of business are understood. We transform ideas into powerful solutions to help our customers meet their goals, overcome business challenges and thrive in a complex, always changing marketplace.

SPX's Flow Technology segment designs, manufactures and markets engineering solutions and products used to process, blend, meter and transport fluids. We also offer equipment for air and gas filtration and dehydration. Our leading brands have global operations which service the food + beverage, power + energy, and industrial processes.

SPX - An Introduction

Our Extensive Brand Heritage:
Union Pump - David Brown Pumps
DB Guinard Pumps - American Pump - Pumpline
Weir Pumps - Clyde Pumps - Mather & Platt -
Drysdale - WH Allen - Girdlestone -
Allen Gwynnes - Harland

CLYDEUNION PUMPS, AN SPX BRAND - GENERATIONS OF EXPERIENCE
 Whilst the name is relatively new, the ClydeUnion Pumps brand is known worldwide for supplying reliable and robust engineered pumping solutions stemming from over 140 years of industry expertise. Our experience spans across several complex industries including oil and gas, nuclear and conventional power generation, desalination and other key markets relevant to our product portfolio.

› ClydeUnion Pumps

› ClydeUnion Pumps
In-situ oil sands – A global opportunity

Requirements to meet the global demand for energy, coupled with the growing need for diversity of supply, has seen the oil and gas industry increasingly having to move towards challenging “unconventional” oil reserves such as bitumen (heavy oil) extracted from oil sands deposits.

The recovery of heavy oil deposits represents a global opportunity with deposits found in over 70 countries worldwide. Major reserves can be found in Canada, Venezuela, and Russia.

It is Canada’s provinces of Alberta and Saskatchewan, in particular that are leading the way in sector growth and technology advancements.

Whilst some near surface deposits can be accessed by mature mining techniques, the vast majority of reserves require the implementation of advanced in-situ thermal recovery processes.

A variety of different extraction processes exist, depending on the geology and properties of the formations, however it is SAGD (Steam Assisted Gravity Drainage) that is leading the way as the method of choice for many of Canada's current and future planned oil sands development projects.

ENGINEERING EXCELLENCE

ClydeUnion Pumps has extensive experience in SAGD pump applications. From Emulsion wellpad pumps, HP/LP Boiler Feed pumps, to Hydrocarbon transfer and treatment pumps, Water Treatment pumps, or export/sales pumps; ClydeUnion offers a full suite of pumping solutions involved in SAGD central processing plants, well pad facilities and interconnecting pipeline networks.
Driven by customer satisfaction

We appreciate that SAGD operators are increasingly looking for advanced pump technology to optimize production rates. ClydeUnion is able to offer specialised lift pumps that can achieve MTTFs around three times greater than the industry average.

We pride ourselves on our collaborative approach with our customers and suppliers to ensure the optimum engineering solution is achieved.

STEAM ASSISTED GRAVITY DRAINAGE (SAGD) PRINCIPLE

The SAGD extraction process principally comprises pairs of wells; an upper well for steam injection to stimulate the bitumen and a lower well for recovery of the produced fluids. Prior to production, steam is injected into both wells for several months in order to “soak” the oil sands deposit and to stimulate the flow of bitumen. After the soak period production begins by gravity flow of the heated bitumen downwards into the producer well whilst steam continues to be injected into the upper well to maintain the steam chamber and continually stimulate bitumen in the formation. The resulting oil and condensed steam emulsion produced from each well pad is then pumped back to a Central Processing Facility (CPF) for separating, treating, and shipping. ClydeUnion can offer pumping solutions at all stages of these processes.
ClydeUnion Pumps understands the complexity of in-situ oil sands installations. Our comprehensive product range detailed in the following pages provides solutions for all in-situ plant applications. From the rigorous duty requirements of emulsion "pad" pumps to tank transfer pumps and drainage sump pumps ClydeUnion Pumps has many years experience supplying into the in-situ oil sands industry.

Some typical applications by plant section can be seen below, outlining the vast scope of supply ClydeUnion Pumps can offer. Our global manufacturing capability, comprehensive heritage product ranges and local sales and service support means that ClydeUnion Pumps clients benefit from industry leading pumping solutions and product life cycle management.
## Product ranges

### SINGLE + TWO STAGE PUMPS / API 610

<table>
<thead>
<tr>
<th>Designation</th>
<th>CUP</th>
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<th>Head Up to M</th>
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<tr>
<td>Single/two stage axially split between bearings pump</td>
<td>CUP-BB1</td>
<td>15,000</td>
<td>66,000</td>
<td>1,000</td>
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<td>Single stage radially split between bearings pump</td>
<td>CUP-BB2</td>
<td>1,500</td>
<td>6,600</td>
<td>700</td>
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<td>Single stage end suction pump</td>
<td>CUP-OH2</td>
<td>1,700</td>
<td>7,500</td>
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<td>Single stage vertical in-line pump</td>
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<td>1,365</td>
<td>6,000</td>
<td>305</td>
<td>1,000</td>
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<td>Single stage vertical in-line pump</td>
<td>CUP-OH4</td>
<td>1,365</td>
<td>6,000</td>
<td>335</td>
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<td>Single stage sump pump</td>
<td>CUP-VS4</td>
<td>450</td>
<td>2,000</td>
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### MULTI-STAGE PUMPS / API 610

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<td>Multi-stage axially split</td>
<td>CUP-BB3</td>
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<td>Multi-stage barrel radially split pump</td>
<td>CUP-BB5</td>
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<td>Multi-stage vertical diffuser / turbine single case pump</td>
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<tr>
<td>Multi-stage vertical diffuser / turbine double case pump</td>
<td>CUP-VS6</td>
<td>7,000</td>
<td>31,000</td>
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### RECIPROCATING PUMPS / API 674

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<th>Designation</th>
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<td>Power driven small (single acting plunger) - simplex/duplex/triplex</td>
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<td>75</td>
<td>6,900</td>
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<td>Power driven medium (single acting plunger) - tripex/quintex</td>
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<td>385</td>
<td>6,900</td>
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<td>Power driven large (single acting) - tripex/quintex</td>
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<td>645</td>
<td>6,900</td>
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<td>Power driven geared (internally geared)</td>
<td>142</td>
<td>625</td>
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<td>Power driven geared (internally geared)</td>
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<td>680</td>
<td>13,800</td>
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<td>Downhole multiphase lift pump</td>
<td>CUP-HSP</td>
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### NON-API PUMPS

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<tbody>
<tr>
<td>2 pole, multistage, ring section (Ft) &amp; barrel case (Fk) boiler feed pumps</td>
<td>CUP-FT/FK</td>
<td>1,200</td>
<td>5,280</td>
<td>3,500</td>
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<tr>
<td>Single stage vertical in-line pump (ANSI)</td>
<td>CUP-VCM</td>
<td>410</td>
<td>1,800</td>
<td>150</td>
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Product detail - API compliant centrifugal pumps

**CUP-BB1**
Our CUP-BB1 single and two stage pumps are horizontally split, double suction pumps. This range includes either single or double volute casing or diffusers. Two stage pumps incorporate single inlet impellers assembled in the back to back arrangement to ensure correct hydraulic balance with superior reliability.

**TECHNICAL DATA**
- **Capacity:** up to 15,000 m³/hr / 66,000 USgpm
- **Delivered head:** up to 1,000 m / 3,300 feet
- **Temperature:** up to 180°C / 350°F
- **Speeds:** up to 6,000 rpm

**CUP-BB2**
The CUP-BB2 is a heavy duty, horizontal, single or two stage, radially split, between bearing, double suction pump. The pumps rigid body ensures vibration limits are met along with 360° bearing support and heavy centreline mounting. Reliable operation at elevated temperatures is ensured due to a number of cooling methodologies complementing inherently cool running bearing modules.

**TECHNICAL DATA**
- **Capacity:** up to 1,500 m³/hr / 6,600 USgpm
- **Delivered head:** up to 700 m / 2,300 feet
- **Temperature:** up to 427°C / 800°F
- **Speeds:** up to 3,600 rpm

**CUP-BB3**
The CUP-BB3 pump is a heavy duty axial split case horizontal pump with opposing impellers and either double or single suction first stage impeller. These units are specifically designed for heavy duty, medium and high pressure applications.

**TECHNICAL DATA**
- **Capacity:** up to 3,000 m³/hr / 13,200 USgpm
- **Delivered head:** up to 3,350 m / 11,000 feet
- **Temperature:** up to 230°C / 450°F
- **Speeds:** up to 6,500 rpm

**CUP-BB5**
The CUP-BB5 is available in two heavy duty designs: multi-stage diffuser or double case volute types. The full CUP-BB5 range has been designed to produce an advanced pump with reduced whole life costs. All the pump internals can be withdrawn quickly without disturbing pump alignment or pipework. This reduces the time and cost of maintenance.

**TECHNICAL DATA**
- **Capacity:** up to 2,800 m³/hr / 12,350 USgpm
- **Delivered head:** up to 4,100 m / 13,600 feet
- **Temperature:** up to 180°C / 350°F
- **Speeds:** up to 7,000 rpm
The CUP-OH2 pump is a heavy duty, single stage, radially split, overhung end suction machine. The pumps rigid body ensures vibration limits are met along with 360° bearing support and heavy centreline mounting. Reliable operation at elevated temperatures is ensured due to a number of cooling methodologies complementing inherently cool running bearing modules. The CUP-OH2 is a back pull-out design that allows the complete rotating assembly to be removed without disturbing the suction or discharge pipework.

### TECHNICAL DATA
- **Capacity:** up to 1,700 m³/hr / 7,500 USgpm
- **Delivered head:** up to 350 m / 1,148 feet
- **Temperature:** up to 427°C / 800°F
- **Speeds:** up to 4,000 rpm

The CUP-OH3 range is an advanced single stage vertical in-line bearing bracketed centrifugal pump with exceptional flexibility and versatility to meet the requirements of in-situ applications. The unit is ruggedly designed and manufactured for minimum maintenance and heavy-duty requirements. The CUP-OH3 is a back pull out design that allows the complete rotating assembly to be removed without moving the suction or discharge pipework.

### TECHNICAL DATA
- **Capacity:** up to 1,365 m³/hr / 6,000 USgpm
- **Delivered head:** up to 305 m / 1,000 feet
- **Temperature:** up to 370°C / 700°F
- **Speeds:** up to 3,600 rpm

The CUP-OH4 range is an advanced single stage vertical in-line centrifugal pump with exceptional flexibility and versatility to meet the requirements of in-situ applications. This unit is ruggedly designed and manufactured for minimum maintenance and heavy duty applications.

### TECHNICAL DATA
- **Capacity:** up to 1,365 m³/hr / 6,000 USgpm
- **Delivered head:** up to 335 m / 1,100 feet
- **Temperature:** up to 370°C / 700°F
- **Speeds:** up to 3,600 rpm

The CUP-VS1 + CUP-VS6 pumps are a vertical turbine radial flow or axial flow type, multistage, heavy-duty pump designed for wet pit, deep well or canister applications. The CUP-VS1 pump range is engineered without a barrel (suction can), an extensive hydraulic suite gives comprehensive flow and head range coverage. The same pump can be supplied with a suction canister in a VS6 configuration for low NPSH applications.

### TECHNICAL DATA
- **Capacity:** up to 7,000 m³/hr / 31,000 USgpm
- **Delivered head:** up to 600 m / 1,900 feet
- **Temperature:** up to 205°C / 402°F
- **Speeds:** up to 3,600 rpm

The CUP-VS4 pump is a vertical suspended, single-casing volute, line-shaft driven sump pump. The units have been designed to suit customer requirements with lengths available up to six meters sump depth. The simple construction of the pump offers ease of maintenance and reliability.

### TECHNICAL DATA
- **Capacity:** up to 450 m³/hr / 2,000 USgpm
- **Delivered head:** up to 160 m / 520 feet
- **Temperature:** up to 200°C / 392°F
- **Speeds:** up to 3,600 rpm
Product detail - API compliant reciprocating pumps

ClydeUnion Pumps reciprocating power pumps are designed with exceptional versatility to efficiently meet the requirements of a wide variety of pumping applications. These units are ruggedly designed for minimum maintenance and to meet the heavy-duty requirements of continuous duty operation in general industry as well as API 674 services.

These units are driven via electric motors or diesel engines through V-belt or gear reduction. Stuffing boxes are specifically designed for applications to maximise packing life and minimise maintenance. Equipment can be packaged to meet the most stringent requirements of API 674.

**SMALL POWER**
- **Capacity:** up to 17 m³/hr / 75 USgpm
- **Discharge pressure:** up to 6,900 m / 23,000 feet (10,000 psi)
- **Temperature:** up to 182 °C / 360 °F
- **Speeds:** up to 440 rpm depending on model
- **Models include:** SX3, DX5, TX10, TD28, TD30, TD60, TD90

**MEDIUM POWER**
- **Capacity:** up to 87 m³/hr / 385 USgpm
- **Discharge pressure:** up to 6,900 m / 23,000 feet (10,000 psi)
- **Temperature:** up to 177 °C / 350 °F
- **Speeds:** up to 400 rpm depending on model
- **Models include:** QD100, TD120, QD200

**LARGE POWER**
- **Capacity:** up to 146 m³/hr / 645 USgpm
- **Discharge pressure:** up to 6,900 m / 23,000 feet (10,000 psi)
- **Temperature:** up to 177 °C / 350 °F
- **Speeds:** up to 290 rpm
- **Models include:** TD240, QD400
GEARED POWER

Capacity: up to 142 m³/hr / 625 USgpm
Discharge pressure: up to 5,200 m / 17,300 feet (7,500 psi)
Temperature: up to 177 °C / 350 °F
Speeds: up to 385 rpm depending on model
Models include: TX50, TX70, TX90, TX115, TX125, TX150, TX200, QX300

Product detail - Non-API pumps

ClydeUnion Pumps also manufacture various ISO and ANSI standard pumps and a non-API ring section multi stage boiler feed pump (CUP-FT 2 Pole) which provides an extensive product range for general plant applications. For more information on products we have available for your applications please contact a member of our sales team.

CUP-FT/FK (2 pole)
The CUP-FT/FK (2 Pole) is a world class product range designed for boiler feed and steam generating applications. The range is a radially split case diffuse type pump with options for through bolt (FT) or barrel case (FK), designed for low, intermediate and high temperature applications.

TECHNICAL DATA
Capacity: up to 1,200 m³/hr / 5,280 USgpm
Delivered head: up to 3,500 m / 11,480 feet
Temperature: up to 190°C / 375°F
Speeds: up to 3,600rpm

CUP-VCM
The CUP-VCM is an advanced single stage vertical in-line centrifugal pump with exceptional flexibility and versatility to meet the requirements of a wide range of pumping applications. The CUP-VSM pump is designed and manufactured to ASME/ANSI B732 standards.

TECHNICAL DATA
Capacity: up to 410 m³/hr / 1,800 USgpm
Delivered head: up to 150 m / 500 feet
Temperature: up to 260°C / 500°F
Speeds: up to 3,600rpm
SAGD operators are increasingly turning to lift pumps to optimise production rates. However, the downhole pumping environment is the most challenging one in the oil industry, characterised by very high temperatures and aggressive fluids. ClydeUnion Pumps high reliability HSP hydraulic drive pump offers an alternative to the often short lived electric submersible pump (ESP) technology. Field experience shows that the water turbine driven HSP can achieve mean time to failure (MTTF) around three times greater than the industry average for ESPs, which provides the opportunity for reductions in work over frequency, costs and deferred oil production.
Other oil sands processes - In-situ + surface mining

**IN-SITU PROCESSES**
As well as the SAGD process, ClydeUnion Pumps provide equipment for the other in-situ oil sands extraction, processing and treatment technologies. Many of the applications previously discussed are directly applicable to the surface processes used in the following alternative in-situ processes.

**CYCLIC STEAM STIMULATION (CSS)**
CSS is an alternative process to SAGD focussing on cyclic loading of single wells by steam stimulation followed by production. CSS surface equipment is similar to SAGD and as such applications discussed in this brochure are also directly applicable to CSS.

**TOE TO HEEL AIR INJECTION (THAI)**
THAI is a relatively new extraction technology that combines initial steam soaking of the bitumen with a combustion front fuelled by continuous air injection and hydrocarbon presence in the well. THAI topside plant is similar to SAGD and CSS but due to the reduced water requirement, water treatment and steam generation plant will be less significant.

**THE VAPOUR EXTRACTION PROCESS (VAPEX)**
VAPEX is similar to SAGD but instead of using steam, stimulation hydrocarbon solvents are used in the injection well to stimulate the bitumen. This process allows some partial upgrading of the bitumen within the sand formation. VAPEX is not as prevalent as SAGD or CSS and is still at an early stage of development. VAPEX topside plant is more heavily weighted to hydrocarbon storage, treatment and solvent injection than SAGD facilities.

**Surface mining**
Surface mining of oil sands and subsequent processing and upgrading to produce synthetic crude oil, is currently the dominant production method for bitumen from the oil sands in Canada, but will be out-produced by in-situ methods in the coming years.

Surface mining plants are on a much bigger scale than most in-situ plants and ClydeUnion Pumps has experience supplying some of the biggest companies in this market for the arduous processes involved.
ClydeUnion Pumps after sales support extends across all of its legacy brands as well as new equipment, and provides full backup for obsolete products and for third party equipment. The parts ClydeUnion Pumps supply meet the original specification, or are upgraded where appropriate, and many components can be covered by a Rapid Response option which can have parts on site within 24 hours.

ClydeUnion Pumps after sales support is subject to the same supply chain management as the pump manufacturing. This provides customers with the lowest lead times and costs whilst meeting the highest standards of quality assurance.

In addition to spare parts, routine servicing, overhauls and inventory control, the aftermarket support covers upgrades and comprehensive technical advice about the potential refitting of existing installations for greater efficiency and reliability. ClydeUnion Pumps can work with your own engineers to carry out meticulous inspections and advise on maintenance schedules, carry out full vibration analysis, pressure and pulsation testing, and train your service personnel.

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WELLHEAD + TREE
Global locations

**EUROPE**

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<tr>
<td>Annecy</td>
<td>+(33) 45 005 5600</td>
<td>+(33) 45 005 5880</td>
<td><a href="mailto:cu.annecy@spx.com">cu.annecy@spx.com</a></td>
</tr>
<tr>
<td>Glasgow</td>
<td>+(44) 141 637 7141</td>
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</tr>
<tr>
<td>Milan</td>
<td>+(39) 02 64 672 230</td>
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<tr>
<td>Moscow</td>
<td>+(7) 495 967 3463</td>
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<tr>
<td>Paris</td>
<td>+(33) 14 717 1440</td>
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<tr>
<td>Penistone</td>
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**AMERICAS**

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<td>Baton Rouge, LA</td>
<td>+(1) 225 779 2560</td>
<td>+(1) 225 774 7965</td>
<td><a href="mailto:cu.batonrouge@spx.com">cu.batonrouge@spx.com</a></td>
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<tr>
<td>Battle Creek, MI</td>
<td>+(1) 269 966 4600</td>
<td>+(1) 269 962 5447</td>
<td><a href="mailto:cu.battlecreek@spx.com">cu.battlecreek@spx.com</a></td>
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<tr>
<td>Burlington, ON</td>
<td>+(1) 905 315 3800</td>
<td>+(1) 905 336 2693</td>
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<tr>
<td>Calgary, AB</td>
<td>+(1) 403 236 8725</td>
<td>+(1) 403 236 7224</td>
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</tr>
<tr>
<td>Los Angeles, CA</td>
<td>+(1) 312 622 2380</td>
<td>+(1) 312 622 2375</td>
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<tr>
<td>Houston, TX</td>
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<td>+(1) 281 372 6042</td>
<td><a href="mailto:cu.houston@spx.com">cu.houston@spx.com</a></td>
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**SOUTH AMERICA**

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<tr>
<td>Itapira, SA</td>
<td>+(55) 19 3843 9820</td>
<td>+(55) 19 3863 3947</td>
<td><a href="mailto:cu.brazil@spx.com">cu.brazil@spx.com</a></td>
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**ASIA**

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<tr>
<td>Beijing</td>
<td>+(86) 106 598 9500</td>
<td>+(86) 106 598 9505</td>
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<tr>
<td>New Delhi</td>
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