Ink Handling System

A.T.E. Enterprises Private Limited (Business Unit: AxisValence)

Date: 25-01-24

Valflow Overview

Valflow – Topics

Valflow ink handling and control system

- Application segments
- The circulating system
- Ink / coats and their nuances
- Ink handling
- Pump options and material constraints
- Filters and their importance
- Why is shade of the ink important
- How do you control the shade
- What is viscosity and how do we measure?
- How is viscosity controlled?
- Temperature vs. viscosity
- Why is it important to control temperature?
- How do we control temperature?

Valflow – Application segments

Valflow products comprise:

- Ink (and coat) handling system

In the following segment:

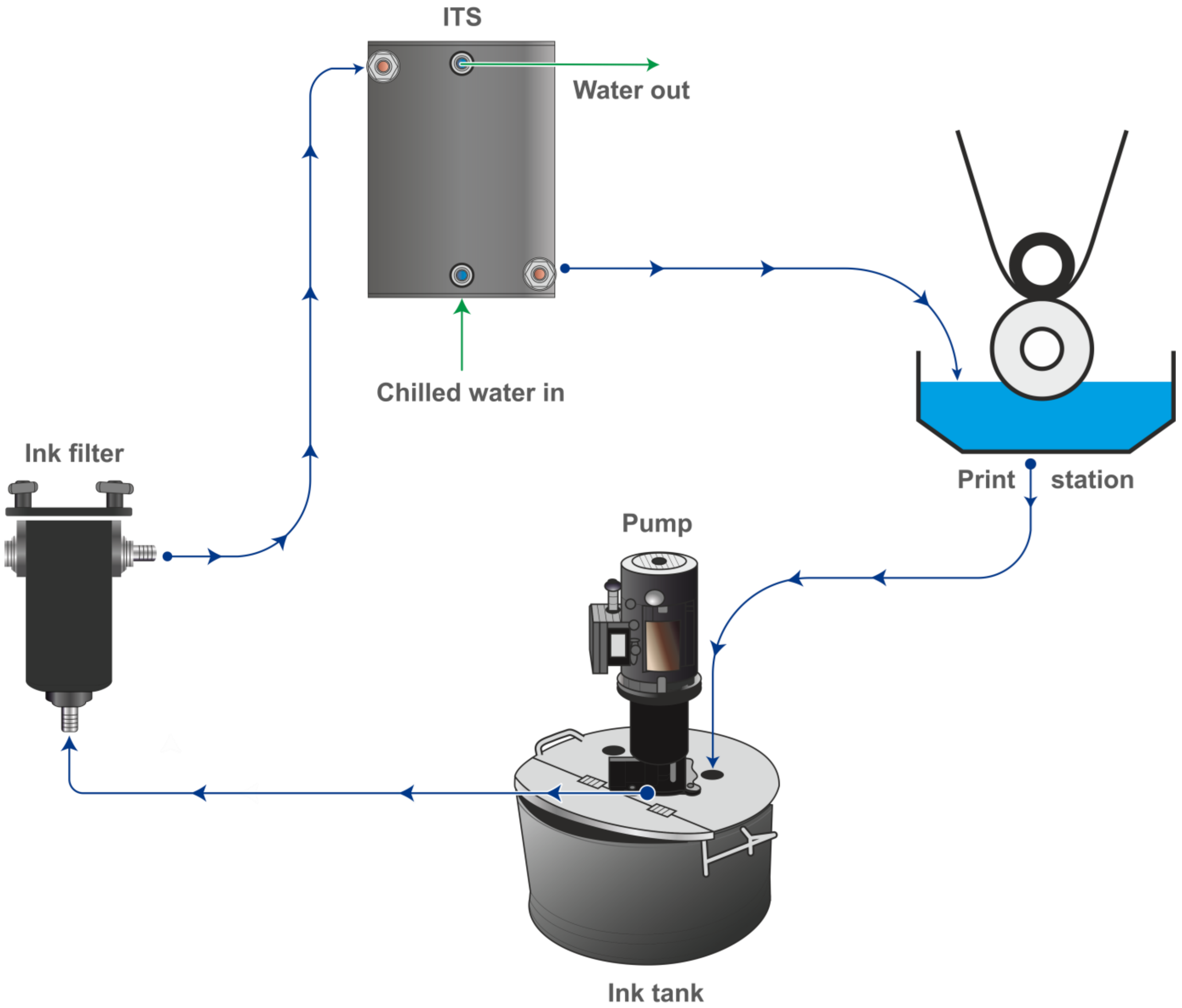
- Paper, film and foil converting (Predominantly in flexible packaging)

Flexible packaging machines using inks/coatings

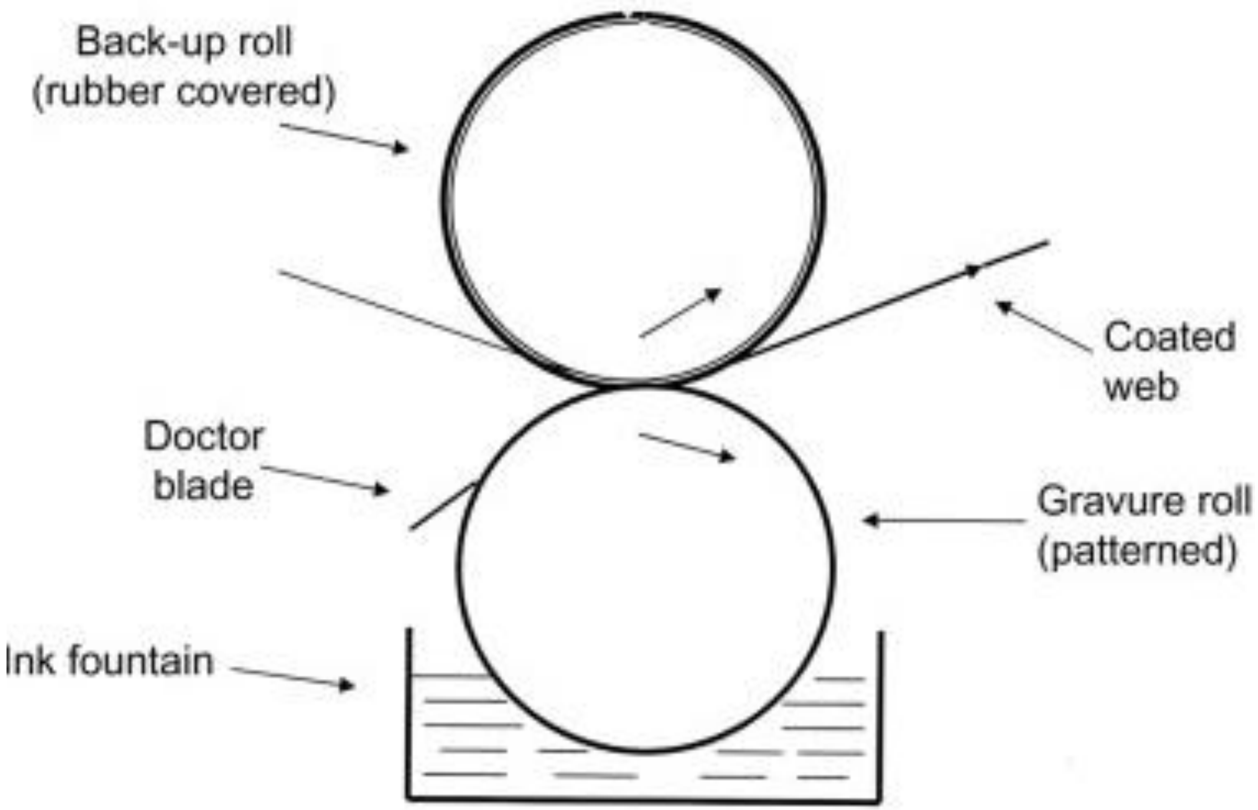
Machines:

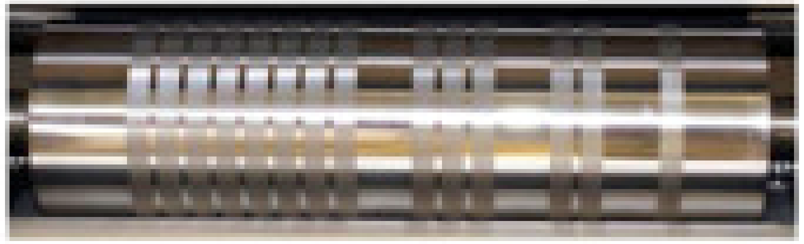
- Rotogravure, Flexographic
- Label Presses
- Coating Machines
- Laminating machines

Ink Handling and Cooling - An Overview



How inks get transferred on the print station – Gravure



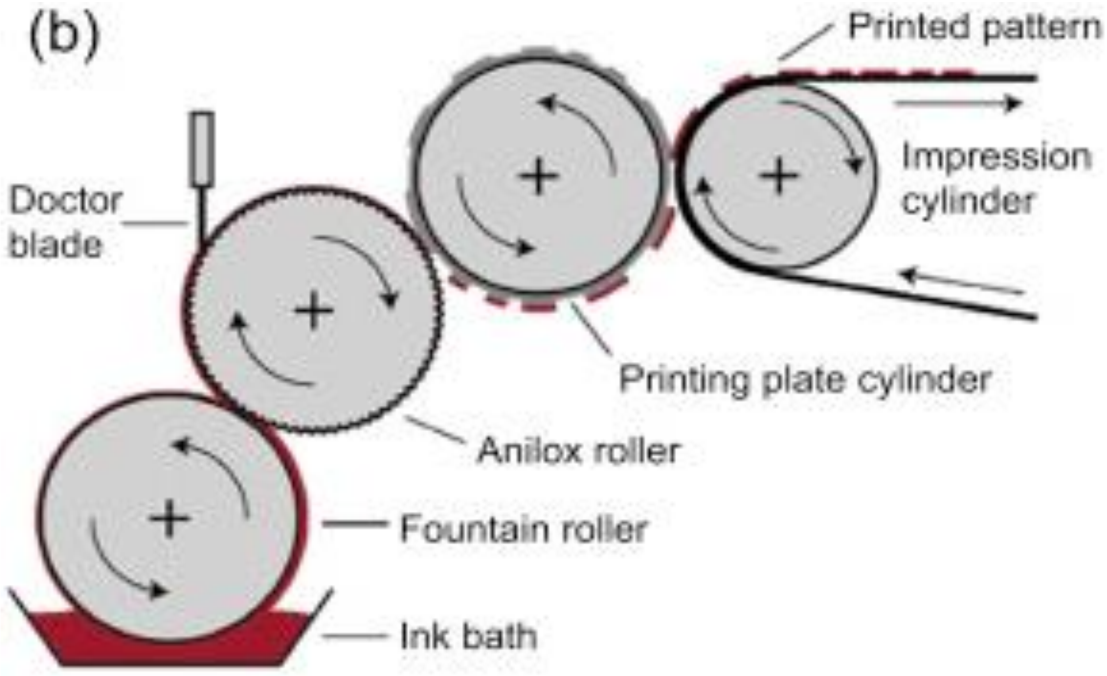


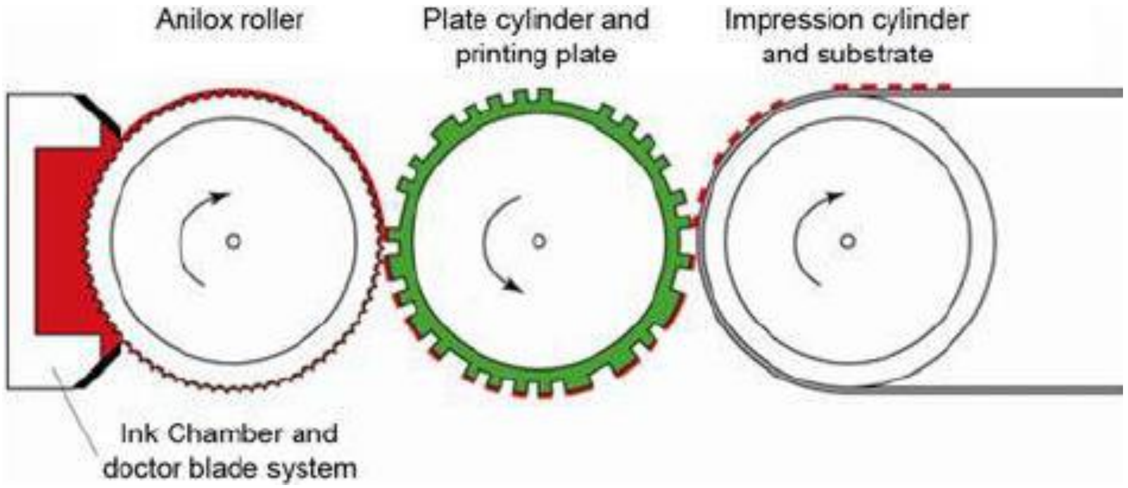
Gravure printing

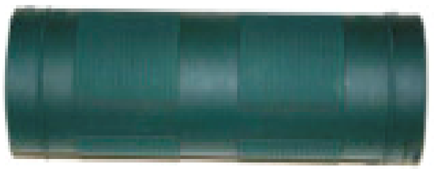
Gravure printing is a type of intaglio printing, using copper engraved, chrome plated cylinders that rotate within a **gravure-ink**-filled pan, which are doctored and then subsequently transfer an image onto the surface substrate (paper, film or foil)

How inks get transferred on the print station – Flexo

Flexographic printing uses a plate **with a** raised surface (relief **printing**) and fast drying fluid inks to **print** directly onto the material







Flexographic printing

Inks, coats and their nuances

A very thin layer of ink gets transferred to the film or paper at each station, and this has to dry up before the film it enters the next print station. Or else smudging occurs

Inks are complex, comprise solvents (petrochemical based), pigments, dyes, resins, lubricants, solubilizers, surfactants, particulate matter, fluorescents, and other materials

Inks are **thixotropic / non-Newtonian liquids.** They are thick or viscous under static conditions and become thinner (less viscous) when shaken or agitated, after which the viscosity is steady for some time. Hence, circulation of the ink is mandatory, before and under running conditions of the machine.

Roto and flexo printing machines have eight colours, and hence that many number of ink circulating system.

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Ink Tanks

Standard ink tanks are round to promote circulation and eliminate "dead spots" in corners where heavier materials can drop out and stagnate, causing viscosity and color issues

A rolled rim at the top of each tank provides reinforcement while eliminating sharp edges. Removable sparkless castors are provided for ease of movement. Tanks are available in 14 gauge epoxy coated mild steel or stainless steel

Centrifugal Pumps

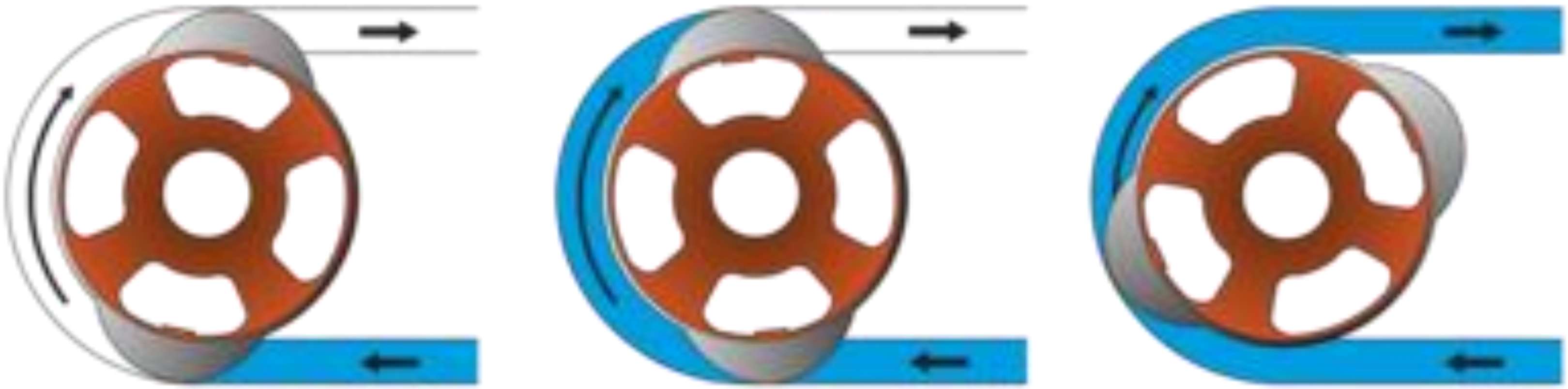
Centrifugal ink pumps are the workhorse of the industry. They are low maintenance, take a lot of abuse, deliver ink in a non-pulsating flow, and provide in-tank circulation to keep the ink blended. Good pumps are Teflon™ coated for easy cleaning. These ink pumps are available with electric, electric explosion-proof, or air motors, with a quick demount option. Flame proof or ATEX Ex motors to be used with solvent based inks. Flow is easily controlled by the use of valves, or varying speed of the motor.

Diaphragm Pumps

For applications requiring controlled flow rates from a trickle to 160 litres per minute. These pumps operate by the movement of two flexible diaphragms which move back and forth, alternately filling and emptying two chambers. Flow is controlled with the air inlet valve, which then determines pump speed. A variety of applications are possible because the pump’s inlets and outlets can be configured in different ways, such as “one-in one-out”, "two-in two-out”, or “2-to-2”. In the 1–to-1 option, one color is sent to the deck. In the “ 2-to-2” configuration, you can deliver one material and also draw it back, or deliver two inks to two different decks. Diaphragm pumps do have a pulsating flow and are best used with surge suppressors / filters.

Peristaltic Pumps

Peristaltic pumps are a type of positive displacement pump used for pumping a variety of fluids. The fluid is contained within a flexible hose or tube fitted inside the pump casing. The actual pumping principle, called peristalsis, is based on alternating compression and relaxation of the hose or tube, drawing content in and propelling product away from the pump.



Ink Filters

Filters are specially designed for flexographic and gravure ink systems, providing effective filtration to eliminate quality problems from contaminants that can also damage costly anilox / gravure rolls.

Valflow® ink filters are designed to overcome the typical pressure drop and reduced ink flow due to clogging that occurs with ordinary filters. A permanent magnet suspended over the intake port traps ferrous particles. Filtered material is trapped on the inside of the removable/reusable stainless steel filter cartridge.

For diaphragm pumps, use surge suppressor filter

What can affect ink color / shade of the ink

Areas to check if color or shade is an issue

1. Temperature & Humidity
2. pH that is too high or low
3. Age of the cylinder
4. A dirty or plugged anilox or gravure roller
5. Viscosity
6. Impression
7. Dot gain and density ….. One colour being too strong
8. Plate and blanket durometer
9. Doctor-blade issues
10. Plate backing material

Viscosity

Viscosity is a physical property of fluids; showing resistance to flow
Viscosity is the state of being thick, sticky, and semi-fluid in consistency, due to internal friction

Dynamic viscosity (also known as **absolute viscosity**) is the measurement of the fluid's internal resistance to flow while **kinematic viscosity** refers to the ratio of **dynamic viscosity** to density
The most commonly use unit for dynamic viscosity is the CGS unit *centipoise* (cP), which is equivalent to 0.01*Poise* (P)
Kinematic viscosity is often measured in the CGS unit *centistokes* (cSt), which is equivalent to 0.01*stokes* (St)

Viscosity made simple

Viscosity is a physical property of fluids; showing resistance to flow. Since cP and cSt are esoteric terms and very difficult to understand, the industry uses a much simpler method to understand and measure the viscosity of process liquids.

The **viscosity cup** is a simple gravity device that permits the timed flow of a **known volume** of liquid passing through a **known orifice** located at the bottom.

Viscosity

There are a variety of viscosity cup sizes and types which will cover different ranges of viscosity.

POISE	0.10	0.15	0.20	0.25	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.20	1.40	1.60	1.80	2.00
CENTIPOISE	10	15	20	25	30	40	50	60	70	80	90	100	120	140	160	180	200
Ford #3			12	15	19	25	29	33	36	41	45	50	58	66			
Ford #4	5	8	10	12	**14**	**18**	22	25	28	31	32	34	41	45	50	54	58
Zahn #1	30	34	37	41	44	52	60	68									
Zahn #2	16	17	18	19	**20**	**22**	24	27	30	34	37	41	49	58	66	74	82
Zahn #3											10	12	14	16	18	20	23
Zahn #4												10	11	13	14	16	17
DIN #4	11	12	14	16	20	23	25	26	28	30	34	38	42	45	49	52	
ISO #4		17	23	34	51	60	68	74	82	93							

Viscosity Controls - Types

The capillary type
The pressure drop across the capillary is measured with a differential pressure transducer

The falling elements type
This can be applied to process using a cylindrical piston moving within the liquid. The speed of movement is then related to the viscosity.

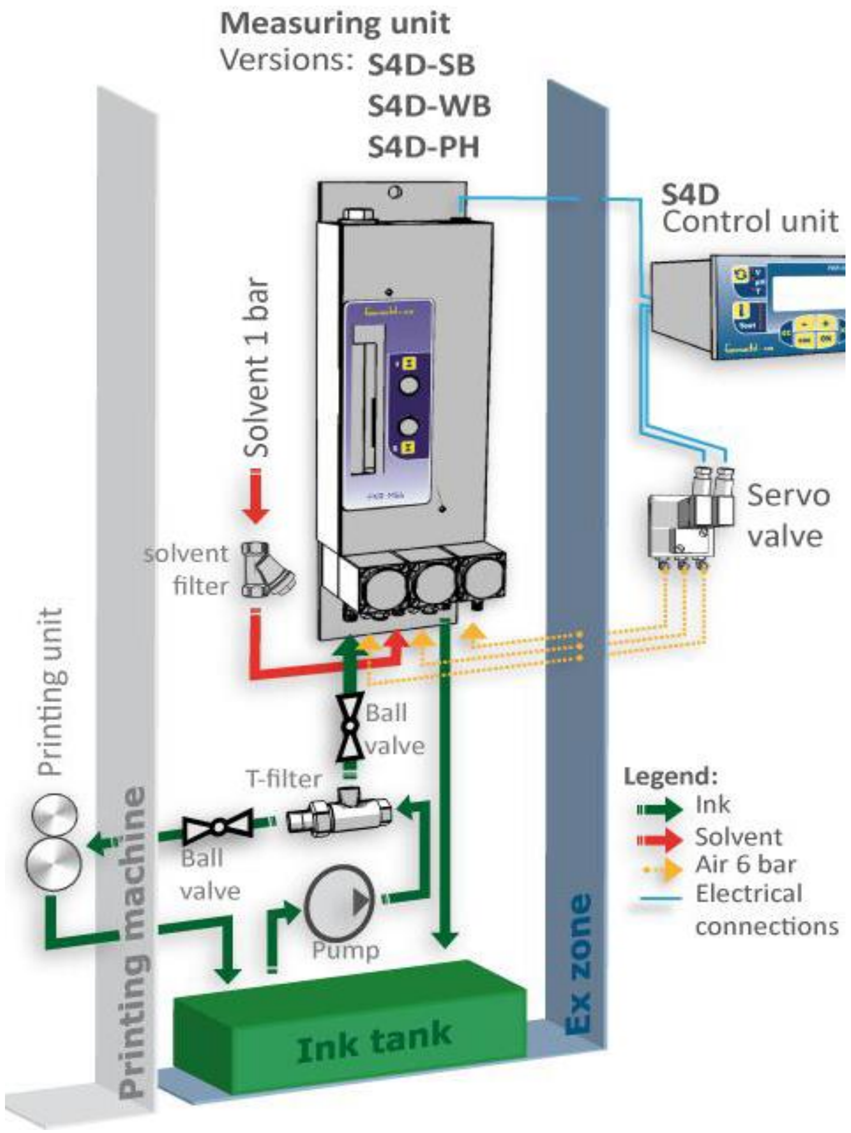
The oscillation type
Vibrational viscometers use a vibrating rod to measure viscosity. By measuring the dampening of the vibration, viscosity can be determined.

The rotation type
Rotational viscometers measure viscosity by measuring the amount of torque required to turn a spindle immersed in the liquid

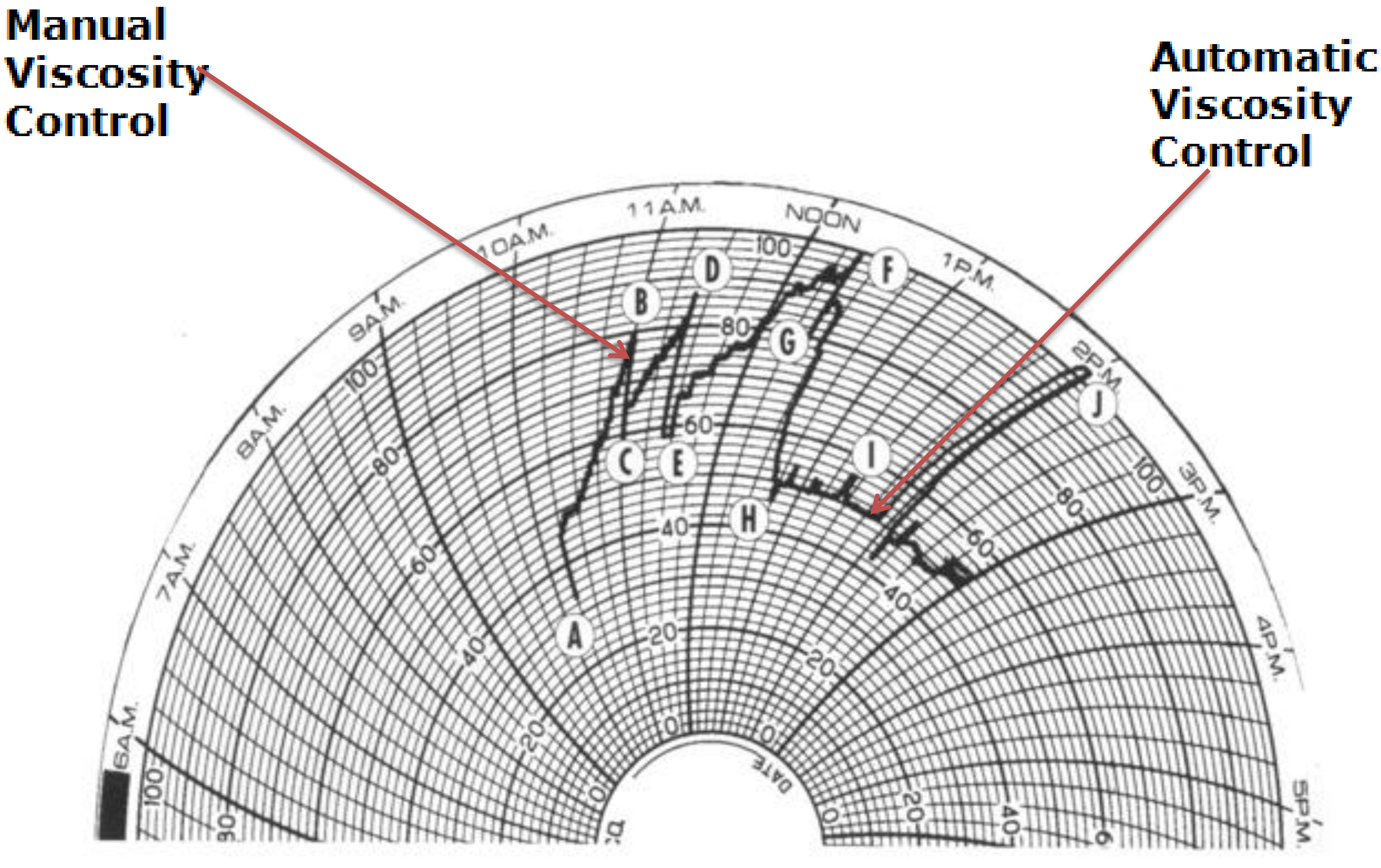
Fasnacht Ink Viscosity Controller

Features and benefits

- Ensures a uniform colour shade across the printing substrate
- Maintains constant ink thickness
- Consistent printing and optimum use of ink and solvents can be realised only with stable viscosity



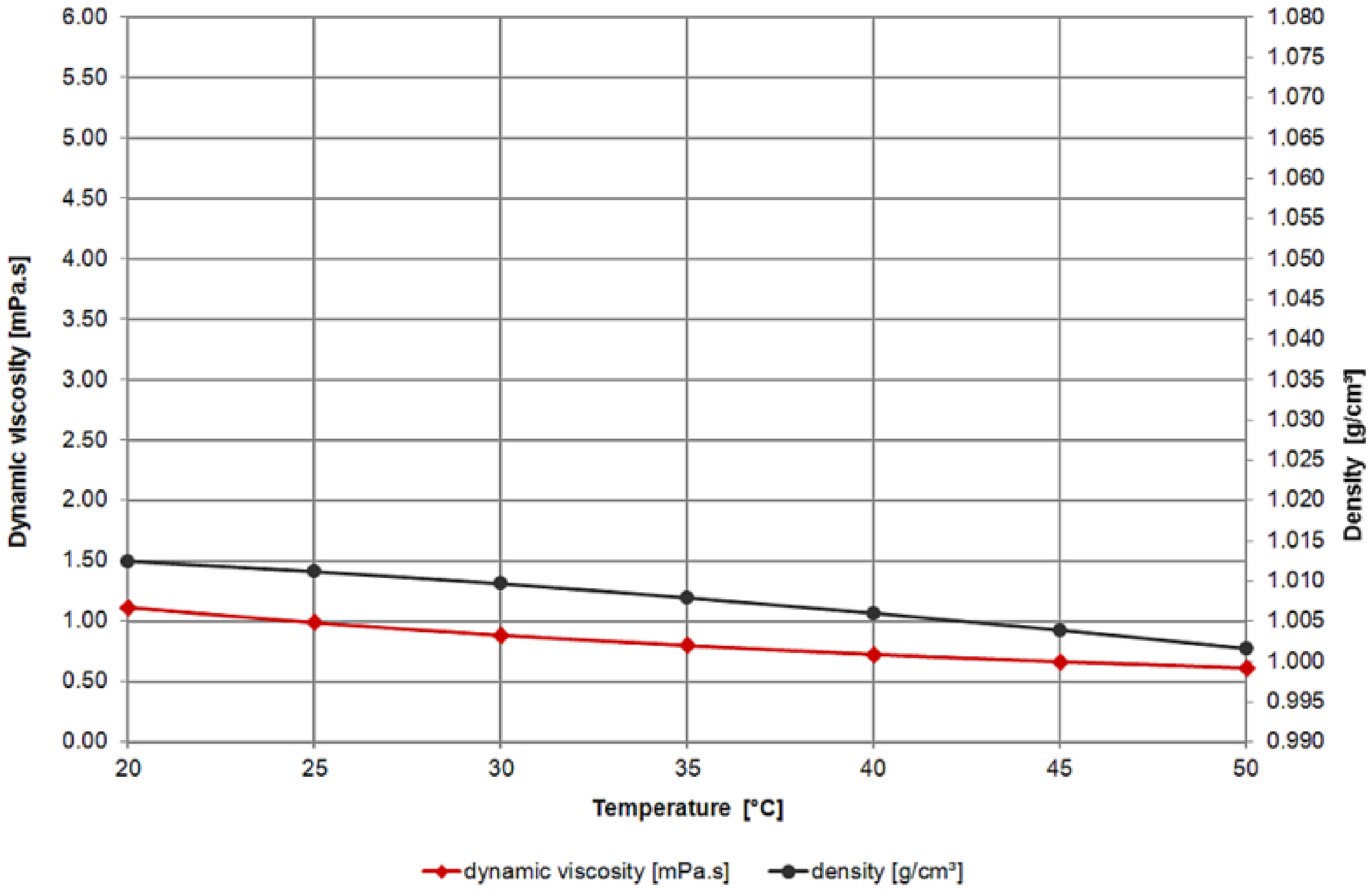
Manual Control vs. Automatic Control



This photo is taken from an actual test done on a flexographic printing press. Viscosity controller was connected to a circular chart recorder, which record ink viscosity over a period of several hours.

Ink Temperature

In general, the viscosity of a simple liquid decreases with increasing temperature. As temperature increases, the average speed of the molecules in a liquid increases and the amount of time they spend "in contact" with their nearest neighbors decreases.



Why Control The Ink Temperature?

Ink kept between 22-25 C results in:

- Better viscosity control and hence uniform shade
- Reduced solvent loss
- Reduced ink consumption
- Substantial Savings
- Better print quality

GAA / EPA Study - Solvent Consumption

The date we will discuss came from two closely controlled test performed by:

The GAA (Gravure Association of America) with the United States Environmental Agency.

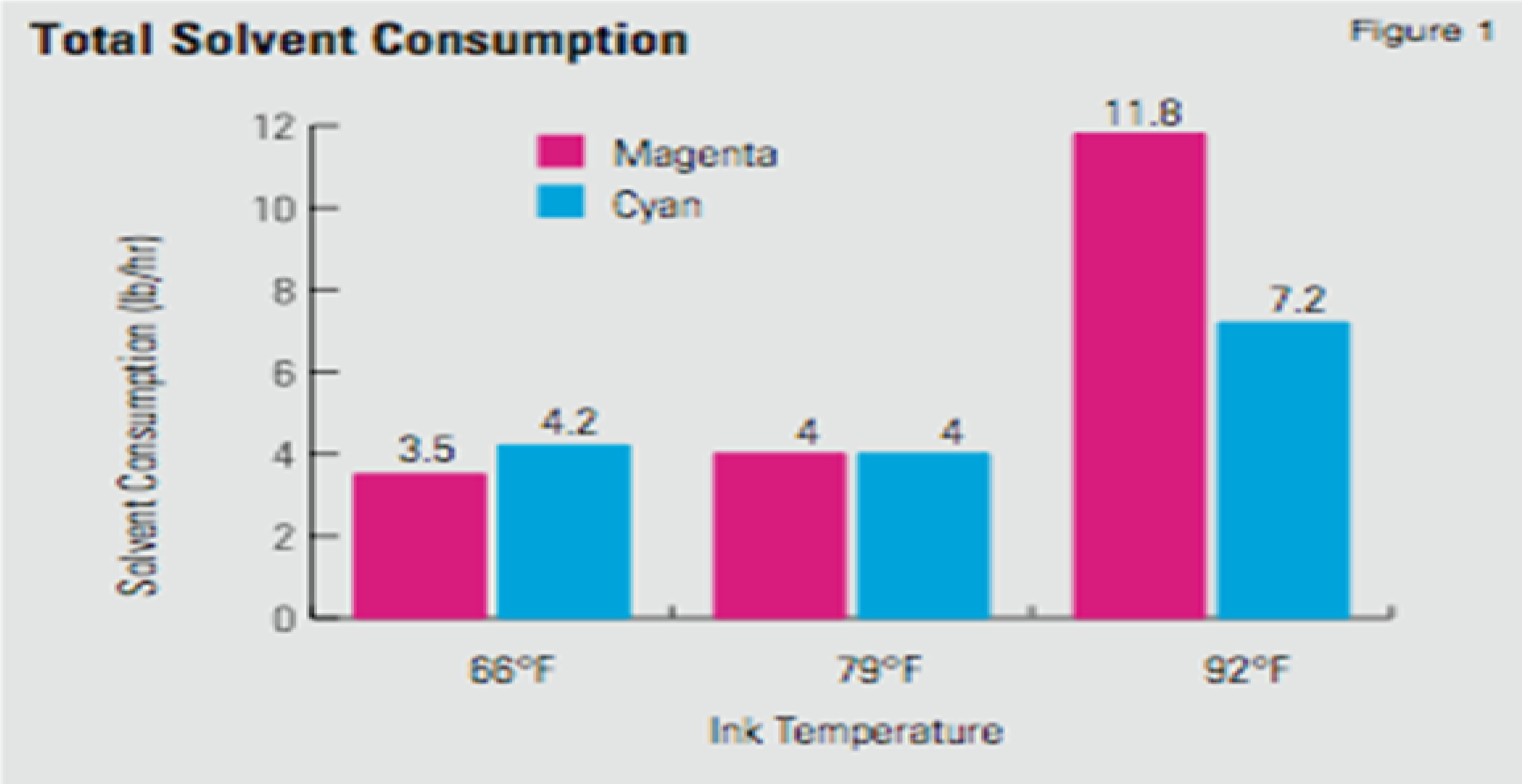
Rod Sosa and Western Michigan University

They were done on a 60cm wide gravure press at 100 meters/minute.

Temperature and Viscosity

When ink is cooled, it becomes thicker and requires more solvent initially to achieve the desires viscosity. However, if it is kept cool (22-25C+/-), the loss of solvent during the print job is substantially reduced.

Celsius	Fahrenheit
0°	32°
5°	41°
10°	50°
15°	59°
20°	68°
25°	77°
30°	86°
35°	95°
40°	104°
45°	113°
50°	122°



WMU Study - Solvent Consumption Magenta

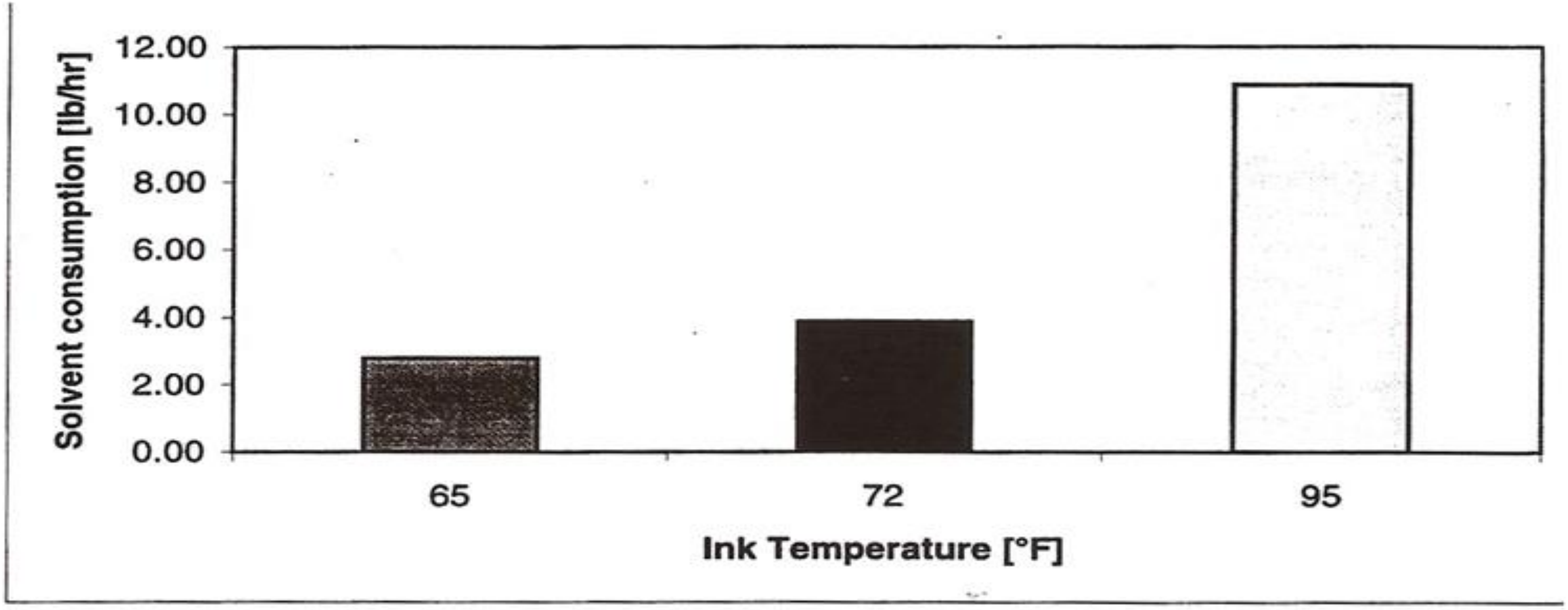


Figure 18. Magenta Solvent Consumption During Trial.

WMU Study - Solvent Consumption Cyan

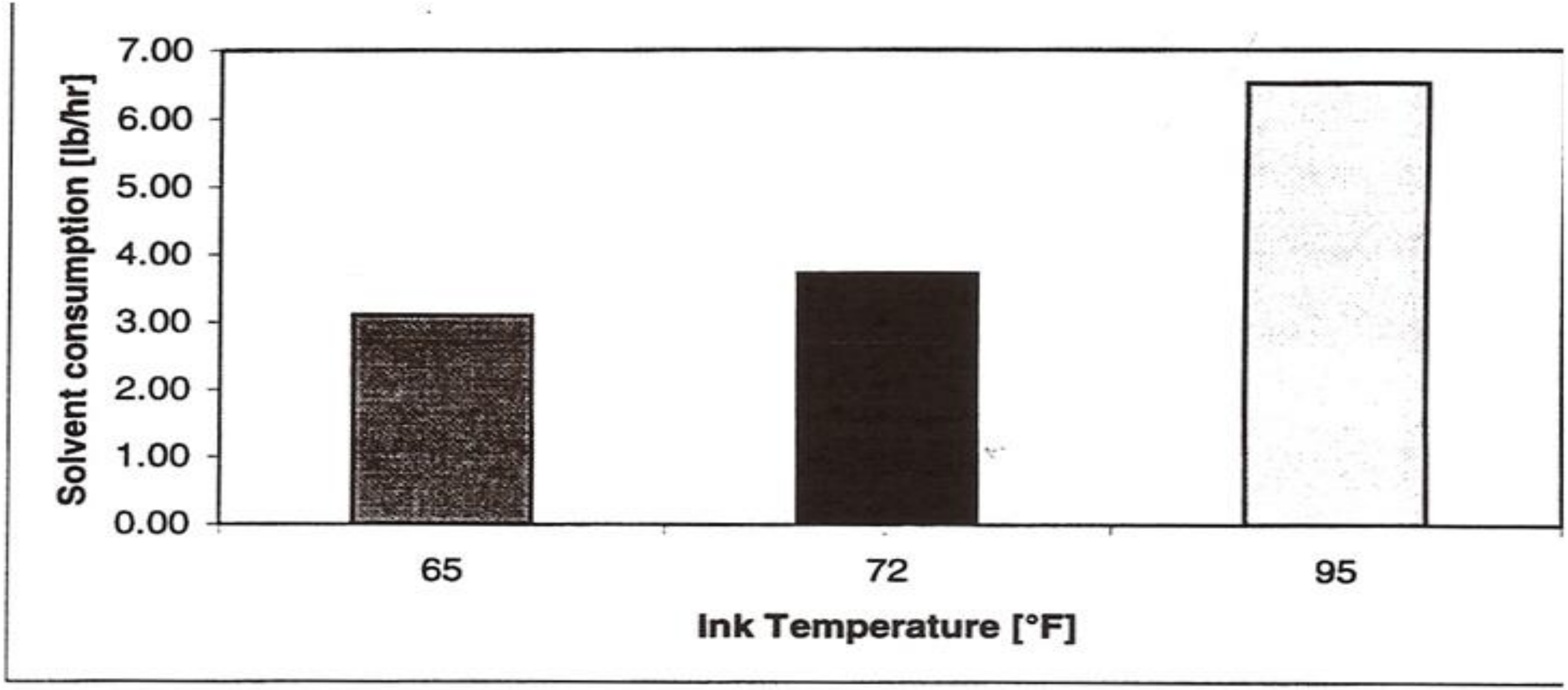


Figure 19. Cyan Solvent Consumption During Trial.

Temperature and Viscosity

Blended ink starts with a ratio of ink (solids, pigments) to solvent.

As ink warms up, it naturally gets thinner and viscosity test will indicate that it is too thin.

As the solvent evaporates out, the warm ink may still measure as “too thin” and indicate the replacement of solvent is not needed.

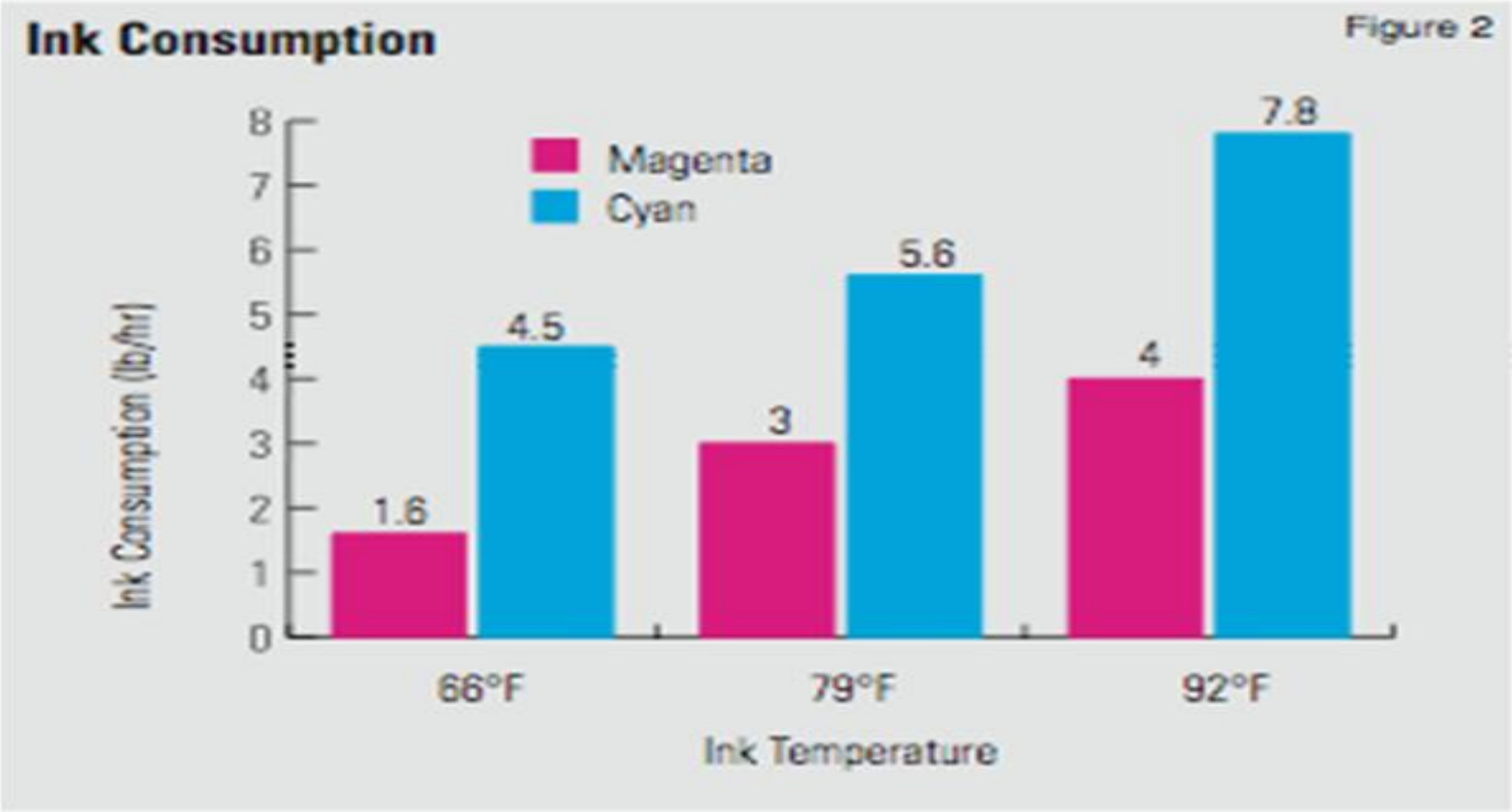
Temperature and Viscosity

The result is that in warm ink you have less% of solvent and more % of solids than in the beginning.

This results in applying a higher % of ink and causes the press to consume more ink.

It costs more to print with warm ink than with cool ink.

GAA / EPA Study
Ink Consumption vs. Temperature



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WMU Study - Total Mass Consumption (Solvent + Ink) Magenta

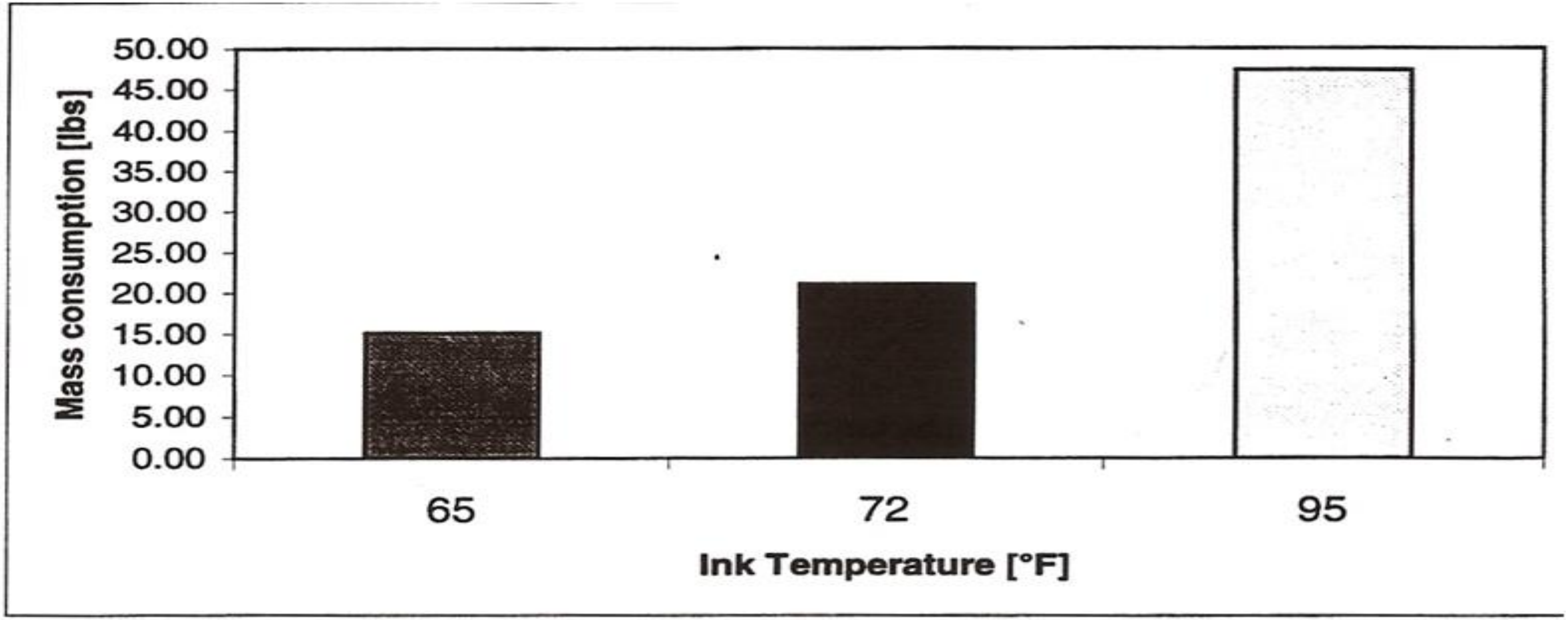
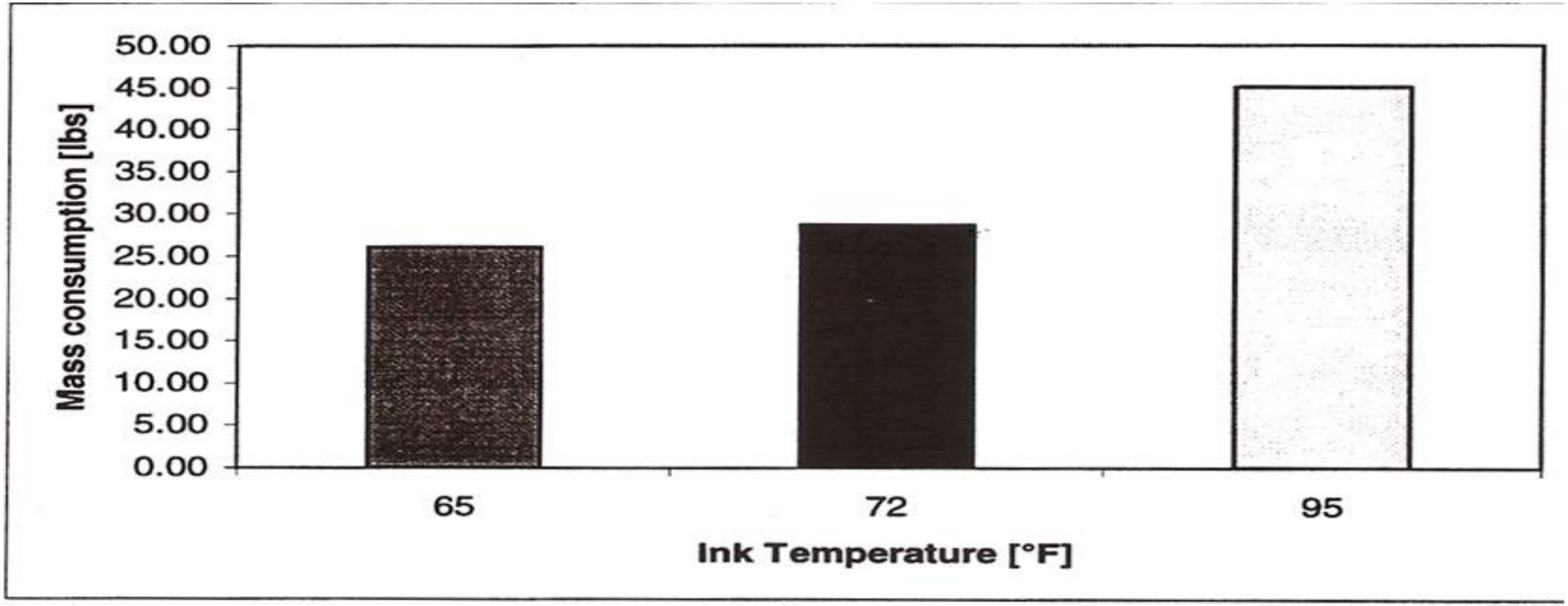


Figure 21. Total Mass Consumption (ink plus solvent) for Magenta, lb.

WMU Study - Total Mass Consumption (Solvent + Ink) Cyan



-igure 20. Total Mass Consumption (ink plus solvent) for Cyan, lb.

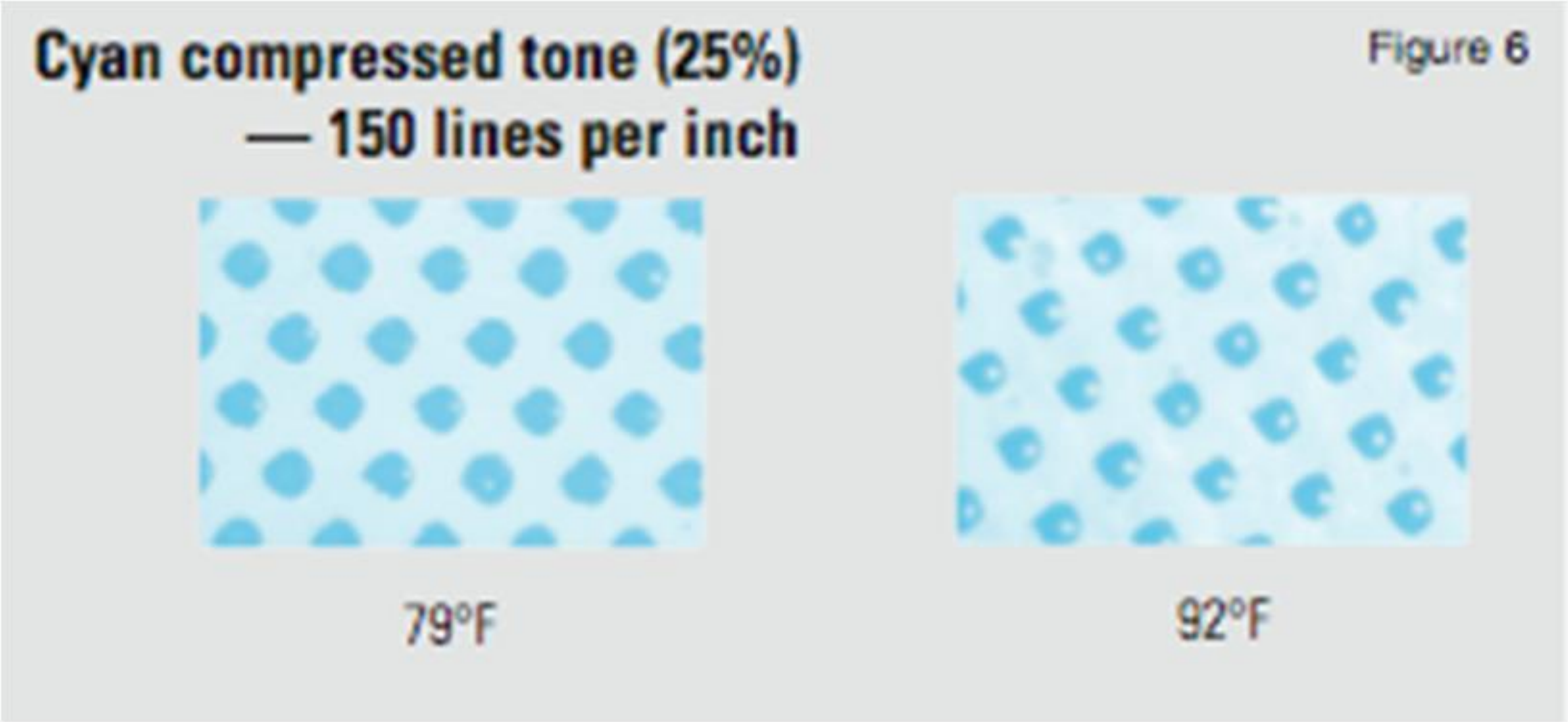
Cool Ink = Better Print Quality

Screen and process printing are accomplished by printing small dots.

When ink gets warm and the % of solids increases (even though the viscosity reads correct) the droplet of ink are not as wet and do not spread uniformly. They dry before they have a chance to “wet out”.

What should print as small solid circles dry as “donuts”.

Warm Ink Causes Poor Dot Quality in Screen and Process Printing



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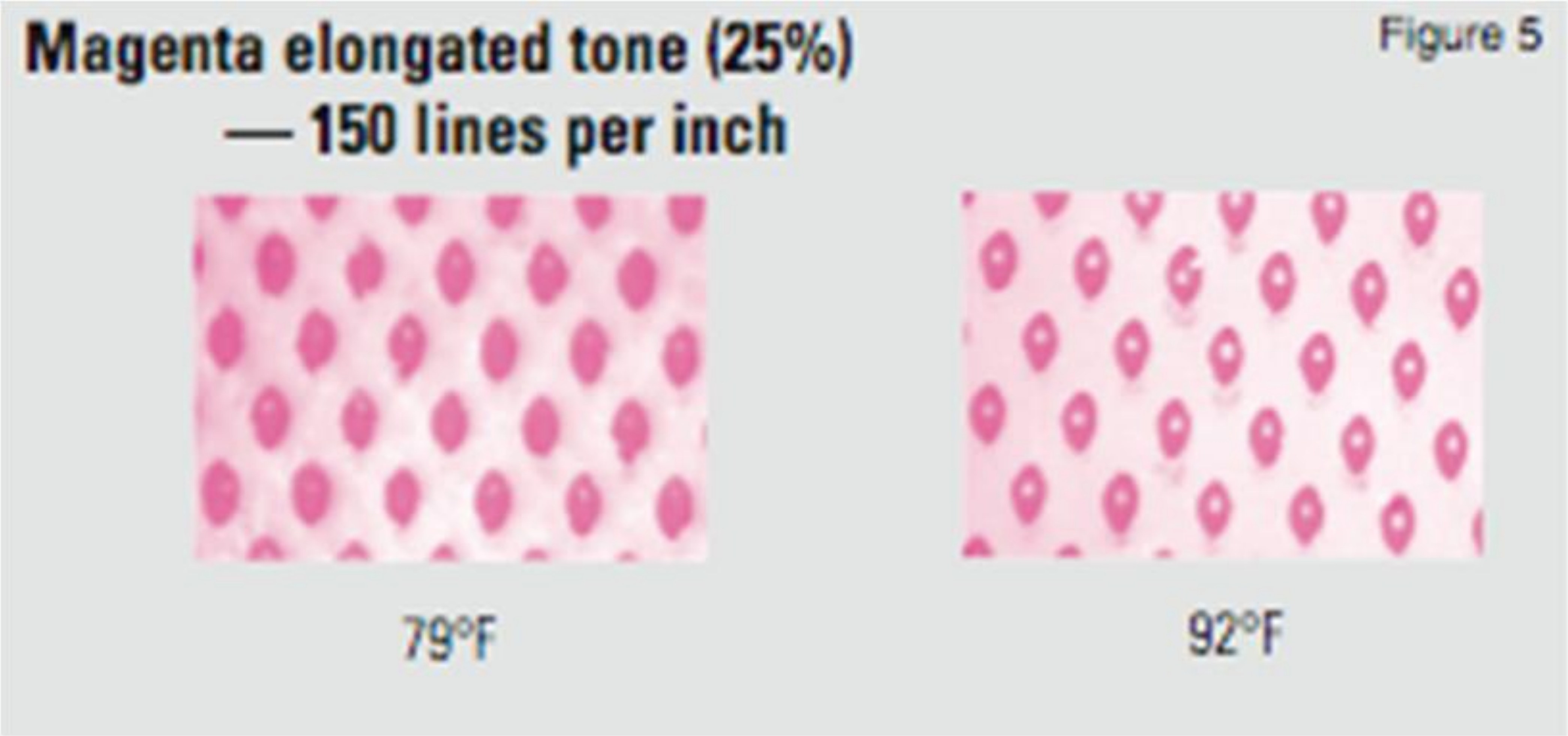
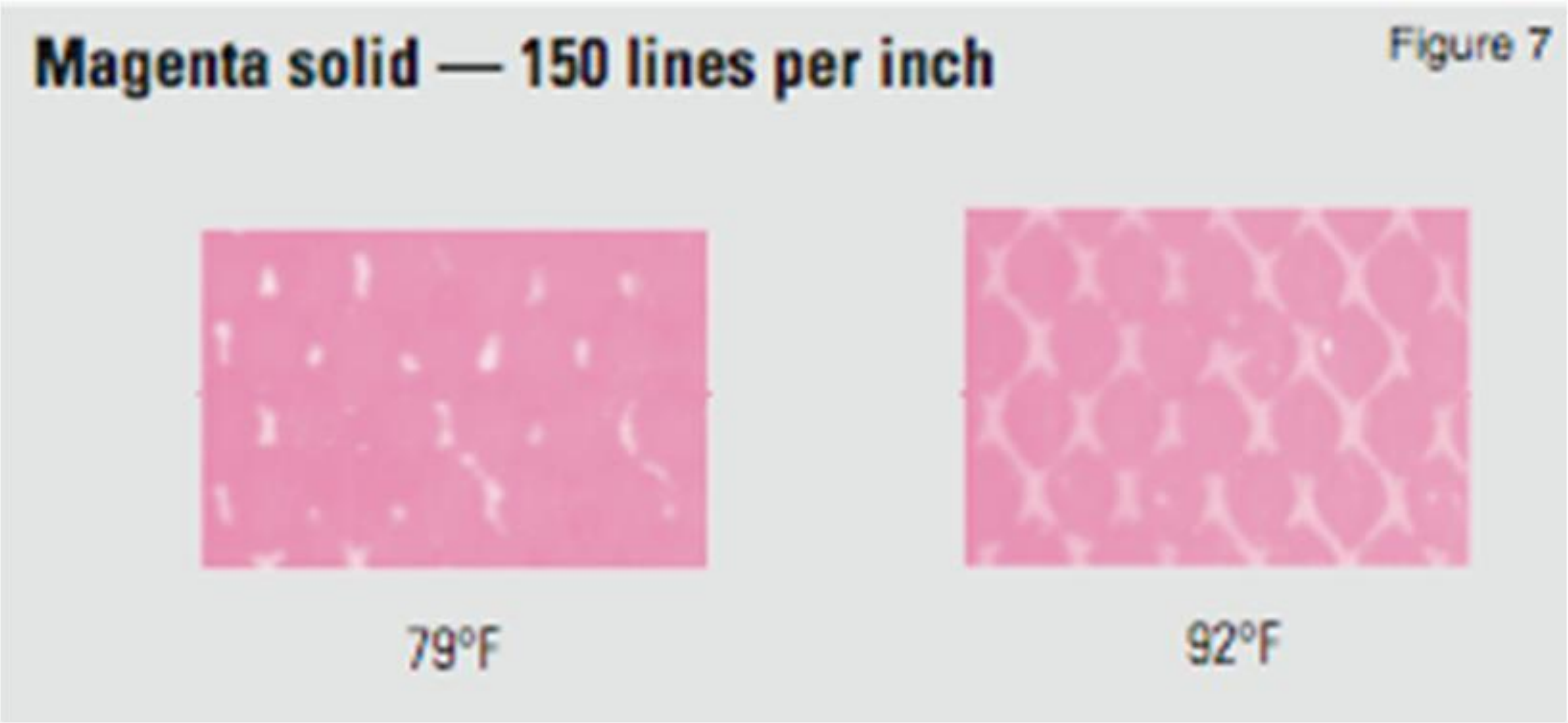


Warm Ink Also Causes Poor Quality in Solid Coverage Printing



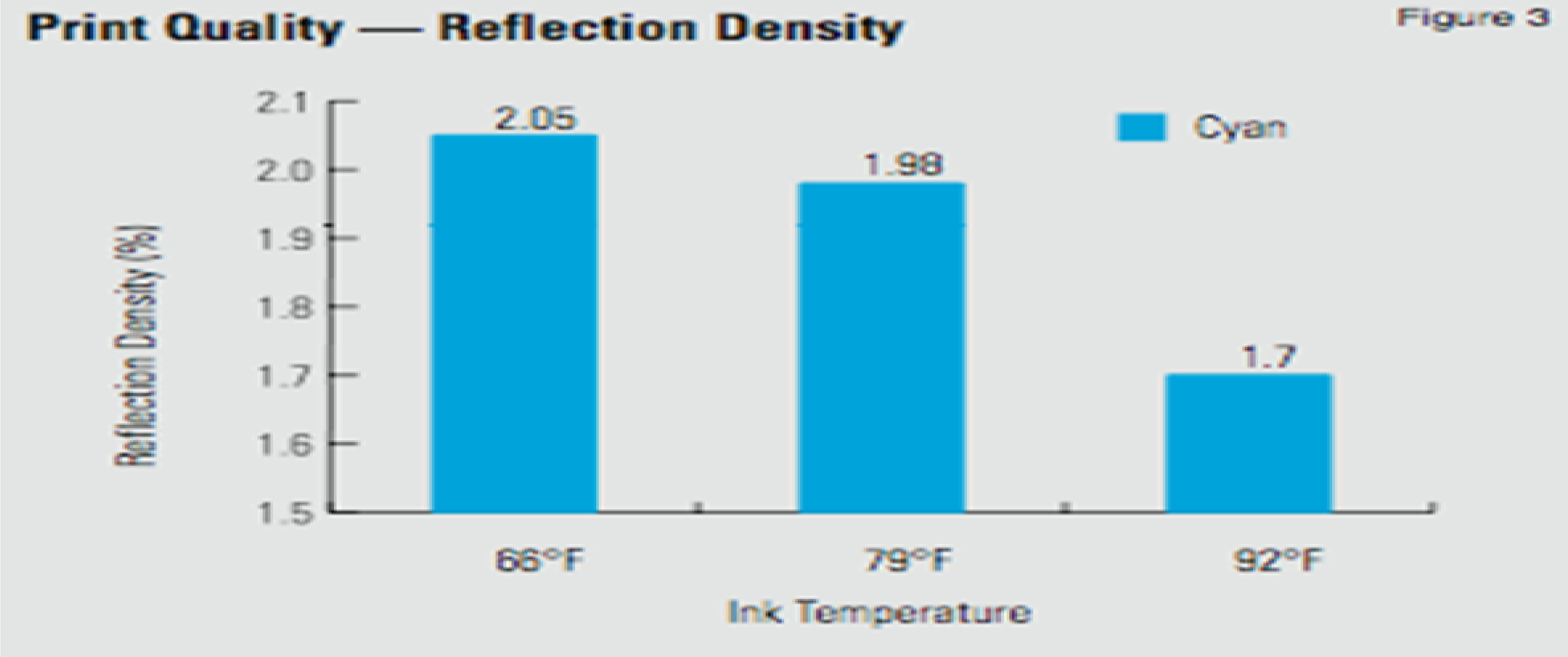
Correct Viscosity Does NOT Equal Correct Color

Traditionally, we have acted as if a constant viscosity = constant color.

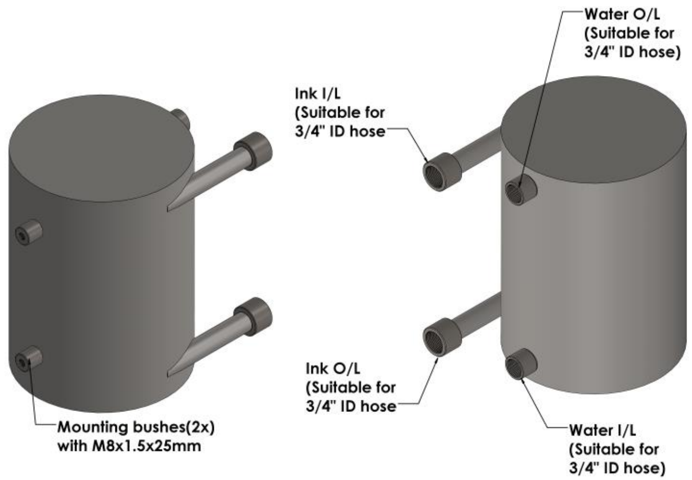
Remember that as ink warms, it becomes thinner, even though some of the solvent has evaporated and solid/solvent ratio has changed.

Warm inks typically print lighter in color, by as much as **15% even though the viscosity reads correct.**

Densitometer Readings From Constant Viscosity Inks



Ink Temperature Stabiliser (ITS)



Features and benefits

- The ITS system cools down the warm ink circulating in the press to a level that suits the process and the ambient conditions
- Ensures consistency of printing, reduces top-up solvent and, in some cases, even ink consumption
- Leak-proof shell and tube heat exchanger design
- Heat transfer is through chilled water

- Consistent print shade
- Saves up to 25% top-up solvent consumption
- High reliability, low maintenance
- Improves print quality

Contact us

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