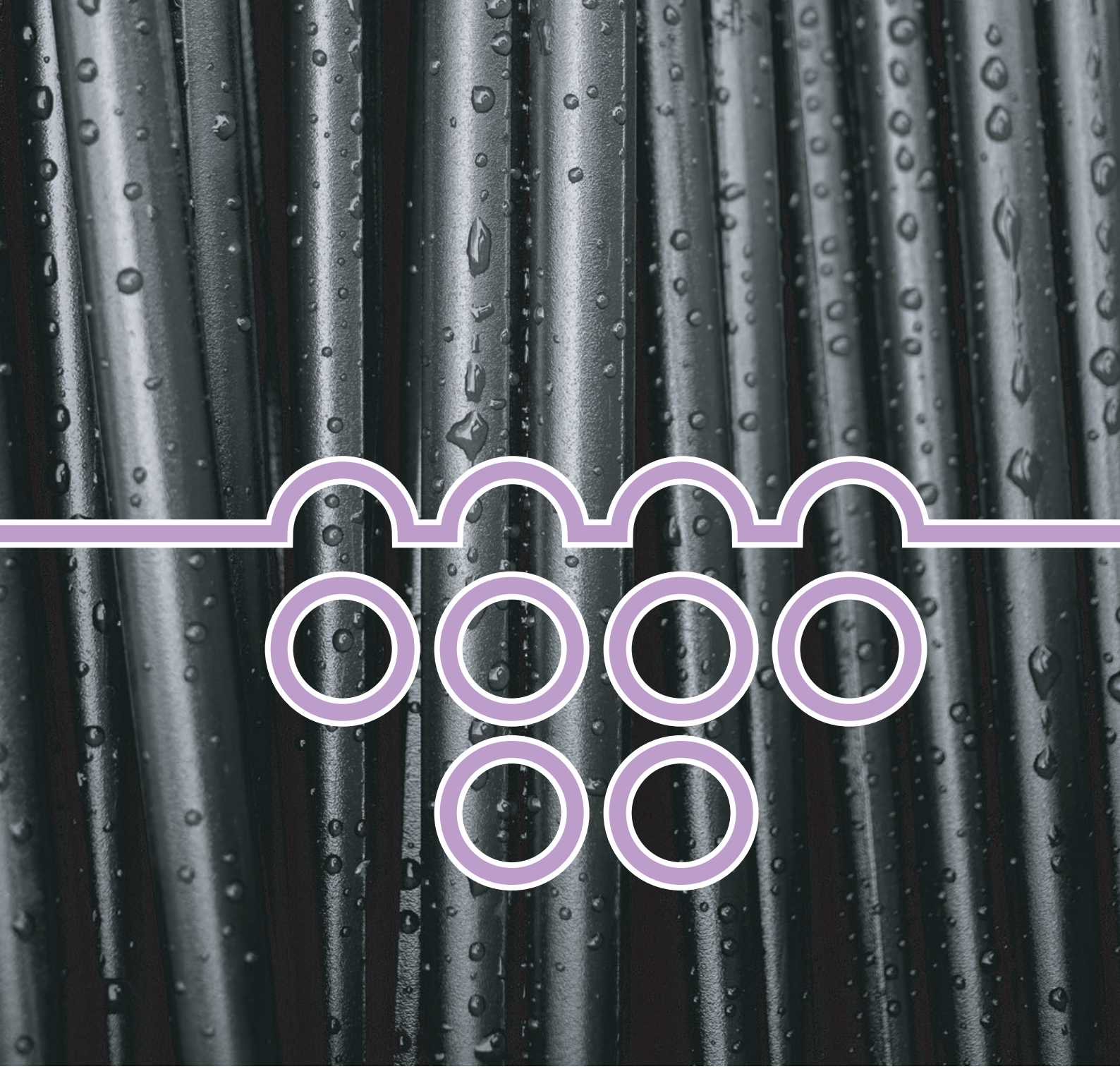


**Reliable protection**
**for your plastic products**

# Functionalities: Kafrit Group Antioxidants

Kafrit Group

Working together for the future of plastics.

Kafrit Group

Kafrit Group is a leading producer of Masterbatches and Compounds for the plastics industry and currently employs more than 470 people. In 2021, the Group achieved USD 302 million $ turnover with an available capacity of more than 120,000 MT. Moreover, the company is active on a global scale and has set up production sites all over the world.

All of this began in 1973 when the company was founded in Israel. Since then, the company has grown primarily via acquisition.

Today, the Kafrit Group incorporates **Kafrit Industries (1993) Ltd. in Israel, CONSTAB Polyolefin Additives GmbH and Delta Kunststoffe AG in Germany, China's Suzhou Constab Engineering Plastics Co. LTD, Polyfil Inc. in the USA, the Canada-based Kafrit NA Ltd. and Addvanze AB in Sweden.** With more than 50 years of experience in the plastics processing industry, the company can draw on high levels of expertise and technical know-how. Kafrit Group places a high value on sustainability and has made it to one of the cornerstones of our corporate strategy.

Our unbridled dedication to environmental, social and financial issues makes us to one of the leading business partners in the plastics industry. Our customers value our passion and appreciate our ecological awareness and social commitment. Moreover, they recognize our world leading services and consider our products as among the best within our industry.

We develop and produce cost-efficient solutions which will enhance the completion of high-quality end products in many areas of the plastics industry, such as packaging films (BOPP, BOPE, CPP, PE), PC sheet, agricultural films and derivatives, biopolymers, flame retardant applications, PEX, pipes, fibers and nonwovens.

- KAFRIT IL 1
- CONSTAB GER 2
- CONSTAB CN 3
- KAFRIT NA 4
- POLYFIL USA 5
- ADDVANZE SWE 6
- DELTA KUNSTSTOFFE GER 7


● Kafrit Group production sites ● Agencies/Distribution

Our Purpose

# Unite talent and technology to drive the future of plastics, together.

This purpose is the driving force of our organization. The reason we do what we do, why we come to work every day. And although our group is made of many different Companies around the world, our purpose unites us.

These three pillars support our purpose

### TOGETHER TO THE FUTURE

The world doesn't stand still, and nor do we. We're always looking ahead, searching for new ways to sustainably grow and thrive. To push our technology and keep working on the next generation of solutions to benefit our customers. Working together in perfect synergy to achieve something great, today and tomorrow.

### TALENT

Around the world, we have hundreds of talented colleagues and partners. All with unique skills, multidisciplinary knowledge, and deep industry experience. Innovators with brilliant ideas and the drive to see them through. People striving for excellence in everything they do.

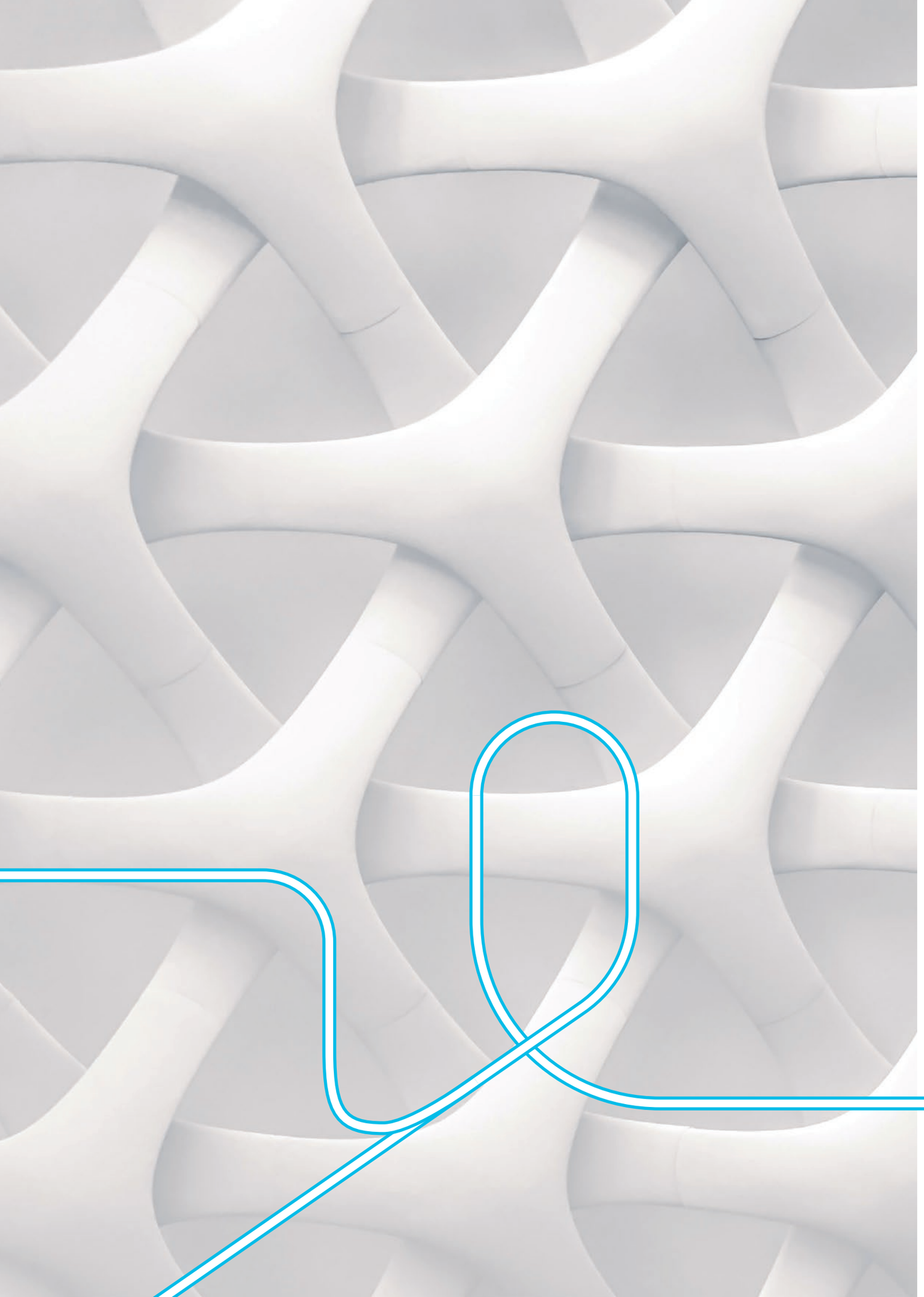
### TECHNOLOGY

After decades in the plastics industry, we have more than high levels of expertise, a strong focus on customer service, and vast technical knowledge. We also have a burning passion for innovation and transformation. A passion that drives us to seek out new solutions, new machinery, and fresh ways to give our customers just what they need.

Together we have the power to drive the future of plastics – within our community and around the world. And we'll keep doing it, today, tomorrow and always.

But the real magic happens when we work together. There's a spark, an energy. A belief that anything is possible. And that's how we provide the best solutions for our customers.

And with the latest technology in our hands and new innovations within our grasp, there's only one question. How far can we go?



Defining new production goals

# Experience the new high performance products

## Research that takes us to the top

Throughout our company history, research and development have always been a key area of our expertise. Kafrit employs a staff of more than 470 people that work on innovative products and make use of our vast pool of knowledge that we developed in 50 years of experience in the plastics industry. Our experts optimize and develop additive concentrates, flame retardants, color concentrates, and compounds for various applications.

Kafrit enjoys a close partnership with renowned research institutions at the Shenkar University in Israel and at different universities in Germany. Moreover, we maintain a strong co-operation with well-known suppliers including machine manufacturers that do recommend our products for use in combination with their machines.

## Antioxidants

Oxidation is a chemical reaction that transfers electrons or hydrogen from a substance to an oxidizing agent. Oxidation reactions produce free radicals, these radicals start chain reactions. **Antioxidants terminate these chain reactions by removing free radicals, and delay other oxidation reactions.** They do this by being oxidized themselves.

### Phenols

- Function as primary antioxidants
  Radical scavengers or chain terminators which trap Alkoxy (RO*) and Peroxy radicals (ROO*).
- Reaction results in Hydroperoxides formation (ROOH) – can lead to further degradation unless secondary AO is present.
- Effective during both – processing and long term heat aging.

### Phosphites

- Act as secondary antioxidants – Hydroperoxides decomposer.
- Often used in combination with a primary antioxidant.
- Provide stabilization only at melt processing temperatures.

### AO effects

Gels and contaminants in extrusion can cause disruption in the extrusion process and quality problems. Main reasons for gels:

- Cross-linked Polymer Gels
- Unmelted resin
- Undispersed additives
- Moisture
- Recycled material – degraded or cross-linked polymer residues

### OIT

The Oxidation Induction Time (OIT) test, as carried out in a Differential Scanning Calorimetry (DSC), is used to predict thermo-oxidative performance of a material.

Samples are heated up under a nitrogen atmosphere, typically to 200°C. Oxygen is then introduced to the sample cell, and the length of time before the onset of degradation, as seen by the initiation of an endothermic process in the DSC trace, is measured.

OIT is a sensitive measure of the level of anti-oxidative additives within the polymer.



# Kafrit Group stabilizer masterbatches reliably protect the polymer structure of your plastic products

PE and PP are degraded by heat and shear during processing. Most imminent are changes in melt viscosity (MFR) and die deposits (die build-up). Typical quality failures, especially during machine cleaning and shut-down/start-up cycles, are discolorations, black specs and gels.

Depending on processing parameters the rate of degradation is worse at higher melt temperatures, longer residence times and higher shear rates along with higher output rates. The degradation is further accelerated by air (oxygen, powder) and humidity (hygroscopy, recycle).

However, the plastic part continues to disintegrate during end usage by elevated temperatures (>50°C) or radiation (UV-light, sterilization): discolorations and loss in physical properties are the most common failures.

Kafrit Group stabilizer masterbatches contain the most advanced antioxidant technology to suppress degradation in your PE and PP applications. Please contact your sales representative to find a product solution that exactly matches your requirements.

**Polymers to be stabilized:**

PE, LDPE, EVA, HDPE, LLDPE, C4/C6/C8, metallocene/ZN
PP, PP-homo, PP-copo, PP-random, PP-terpolymer

**Processing method:**

Film and sheet extrusion
Injection and extrusion blow molding
Melt processing in general

**Food contact:**

European Union – EU
U.S. Food and Drug Administration – FDA

**Typical dosage levels:**

Melt processing of virgin polymers: 0.5% – 1.0%
Melt processing of recycle: 2.0% – 3.0%

**Machine weekend shut downs:**

5% up to 10%

| Product | Reworks & Recycling | Processing Stability | Avoid Gel Formation | Black Spec Elimination | Long Term Heat Stability (LTHS) | | Oxydative Induction Time (OIT) | Dosing % | Main Product Feature |
|---|---|---|---|---|---|---|---|---|---|

# 1. Polyethylene

## 1.1 Antioxidants for Agricultural Film

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **ST 04400 LL** | ++ | +++ | +++ | + | + | | + | 1.0 – 5.0 | Heat stability and improved process stabilization in combination with UV-stabilization. |
| **ST 0C010 LD** | + | +++ | +++ | ++ | + | | + | 1.0 – 5.0 | Excellent for process stabilization of HDPE monofilaments and slit tapes. |

## 1.2 Antioxidants for Industrial and Food Packaging Film

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **ST 03001 LD** | - | - | - | - | ++ | | ++ | 1.0 – 3.0 | Long term heat stability without synergist: i.e. industrial and food packaging films. |
| **ST 03003 LD** | +++ | ++ | ++ | ++ | +++ | | +++ | 0.5 – 1.5<br>up to 10 | Resistant against hydrolysis and water extraction: i.e. water pipes, dishwashers, washing machines. Stabilization during: week end shut down/start up procedures or flush cleaning of an extrusion line. |
| **ST 03023 LD** | - | - | - | + | +++ | | +++ | 0.5 – 2.0 | Long term heat stability: i.e. technical applications, automotive, injection molding. |
| **ST 03040 LD** | ++ | +++ | +++ | +++ | - | | 0 | 1.0 – 3.0 | Basic product for improved process stabilization: i.e. in combination with UV-stabilization. |
| **ST 06341 LD** | +++ | ++ | ++ | ++ | +++ | | +++ | 1.0 – 5.0 | Long term heat stability: i.e. technical applications, pipes. |
| **ST 0A880 LL** | +++ | +++ | +++ | ++ | ++ | | ++ | 0.5 – 2.5 | Improved heat stability: i.e. sterilization, pipes, injection molding. |
| **ST 00S53 LL** | ++ | +++ | +++ | + | - | | - | 1.0 – 6.0 | Process stabilization without synergist: i.e. sensitive polymers, high melt temperatures. |
| **ST 00015 LD** | + | ++ | ++ | 0 | - | | - | 1.0 – 5.0 | Same functionality as ST 00S53 LL, cost reduction masterbatch. |

# 2. Polypropylene

## 2.1 Antioxidants for Industrial and Food Packaging Film

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **ST 03002 PP** | - | - | | - | + | | + | 1.0 -3.0 | Long term heat stability without synergist: i.e. industrial and food packaging films. |
| **ST 03003 PP** | +++ | ++ | | ++ | +++ | | +++ | 0.5 – 1.5<br>up to 10 | Resistant against hydrolysis and water extraction: i.e. water pipes, dishwashers, washing machines. Stabilization during: week end shut down / start up procedures or flush cleaning of an extrusion line. |
| **ST 03200 PPR** | ++ | - | | 0 | +++ | | +++ | 1.0 – 5.0 | Long term heat stability: i.e. technical applications, pipes. |
| **ST 03022 PP** | ++ | +++ | | ++ | +++ | | ++ | 0.5 – 2.0 | Resistant against gas fading, especially with PP fibers. |
| **ST 03023 PP** | - | - | | + | +++ | | +++ | 0.5 – 2.0 | Long term heat stability: i.e. technical applications, automotive, injection molding. |
| **ST 0A880 PP** | +++ | +++ | | ++ | ++ | | ++ | 0.5 – 2.5 | Improved heat stability: i.e. sterilization, pipes, injection molding. |

## COMBI BATCH

| | | | |
|---|---|---|---|
| NEW! **PA 00S08 LD** | Combination of Processing Aid and Antioxidant High processing or melt temperatures, die build-up reduction, reduced gel formation, for cast films and pipes. | 0.5 – 2.5 | Can eliminate degradation and die built-up: i.e. high melt temperatures. |

Evaluation: excellent +++ recommended ++ good + basic 0 not recommended -

Kafrit Group

**Please request for further information:**

**BOPP**
Optimizing BOPP film production
with CONSTAB® Masterbatches and Compounds

**BOPE**
Sustainable solutions for flexible packaging films
with CONSTAB® CON-X® Masterbatches

**Functionalities: Ecocell® – Lighten up!**
A revolutionary foaming agent
to reduce material and resin consumption

**Functionalities: Kafrit Group Antioxidants**
Reliable protection for your plastic products

**Functionalities: Conpeel**
Strong protection, easy peeling
with CONSTAB CONPEEL® Compounds

**Polyethylene Packaging, Polypropylene Cast and Calender Films**
Rolling to success with Kafrit Group
Masterbatches and Compounds

**Polycarbonate and PMMA Sheets**
for a transparent view with Kafrit Masterbatches
and Compounds

**Pipes and Sheets**
Customized solutions with Kafrit Group
Masterbatches and Compounds

**Injection Molding, Blow Molding**
Injecting new ideas into your products with
Kafrit Group Masterbatches and Compounds

**Nonwovens**
Adding value to Fibers and Nonwovens
with Kafrit Group Masterbatches

**Agricultural Film**
Growing success with Kafrit Group
Masterbatches and Compounds

Global supply, local partnership:
**We are where you are.**

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